THE MODEL ENGINEER

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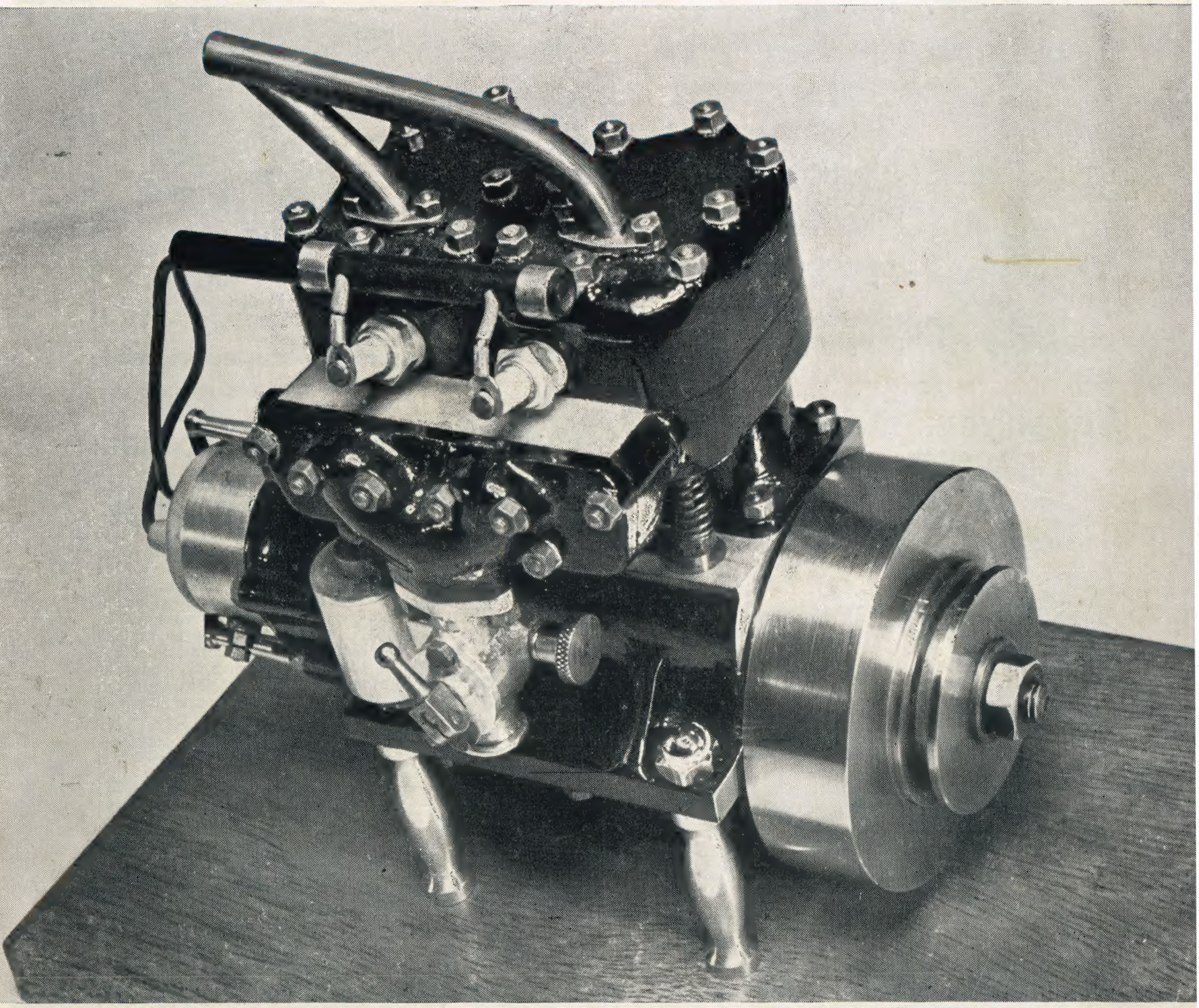

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● AUTOMATIC CROSS-FEED FOR THE LATHE ● A SIMPLE BATTERY-OPERATED ROWING BOAT ● READERS' LETTERS ● REBUILDING A STEAM TRACTOR ● A PARTING TOOL FOR THE BACK-TOOLPOST ● MAKING SMALL BUTTON DIES

APRIL 14th 1955
Vol. 112 No. 2812

9D

JUST PUBLISHED

Soldering & Brazing

The author has approached his subject with two aspects in mind : the "why" and the "how." What is loosely referred to as soldering can be divided into three categories : soft soldering using alloys of comparatively low melting points ; hard solders with higher melting points ; and brasses used for brazing with melting points of 800 deg. C. and upwards. Each category is discussed from the point of view of melting point, plastic range, viscosity, strength, cost, electrical conductivity, etc. The author explains why a certain result can, or cannot, be achieved. Later in the book the reader is instructed how to go about the job in the light of this theoretical knowledge. There are also chapters on fluxes and heating devices, numerous illustrations by the author, useful tables, and a number of photograph plates.

by
A. R. TURPIN

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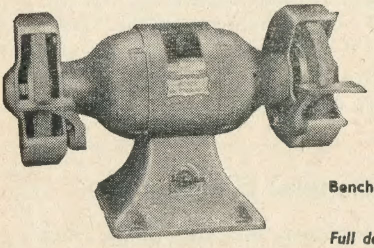

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THE MODEL ENGINEER

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SMOKE RINGS

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Technical Editors
J. N. MASKELYNE, A.I.Loco.E.
E. T. WESTBURY
E. BOWNESS, A.I.N.A.

Features Editor J. D. McLINTOCK

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CONTENTS

OUR COVER PICTURE

This picture shows an excellent example of the 10 c.c. "Seagull" twin petrol engine, built by Mr. H. Bown, of Sheffield, to the design published in "The Model Engineer" in July to December, 1950. All the patterns for castings were made by the constructor, and the drawings and description were carefully followed, resulting in a very satisfactory working model. It may be mentioned that many "Seagull" engines built by readers have been fitted to model power boats, including some with radio control. The photograph was taken by Mr. E. G. Gardner, of Sheffield.

Hot Air Engines

THE MANY readers of THE MODEL ENGINEER who have expressed a wish for further articles or other information on this subject will be interested to learn that some typical examples of hot air engines are now on view at the South Kensington Museum, including a model of Stirling's engine (1816), Cayley's engine (1807) improved by H. Messer (1863-4), Bailey's engine, after Lauberean's patent (1845), Ericsson's "caloric" engine (circa 1869) Rider's engine (1871-7), and Lowne's atmospheric engine (1889-97). Also a copy of the drawing of Amonton's "fire-mill" (1699).

The curators of the museum wish to augment and extend this collection, in view of the continued widespread interest in engines of this type, and would welcome any information on existing examples, models, descriptions or illustrations which would form useful links in the chain of development. If any readers can assist in this respect, we shall be pleased to pass on communications to the curators, as we are equally interested in preserving records or relics of a type of motive power engine which once showed great promise, and may even yet return in an improved form to play an important part in modern mechanisation.

Festiniog Railway

STEADY PROGRESS is being made in the preparations for running a service of trains between Portmadoc and Minffordd during the coming summer. Two fitters are employed full-time on the locomotive *Prince* in the company's works at Boston Lodge, where electricity has been installed and certain essential items of plant restored to working order, and there is every prospect that this locomotive will be ready for the road in the near future. In addition, a number of coaches are in course of preparation. The livery decided upon is dark green for locomotives and dark green with ivory upper panels for coaches.

Repairs to the permanent way between Portmadoc and Minffordd include an extensive programme of re-sleepering, which has already been begun.

In the meantime, track clearance on the upper stretches of the line is well in hand, and a number of journeys between Portmadoc and Blaenau Festiniog have been made by the Simplex petrol tractor, hauling a 4-wheeled brake van.

The Festiniog Railway Society is inviting applications for membership from all who are interested in seeing the line running once more, and the response to the issue of their initial brochures on the subject has been most encouraging. Full particulars of membership, etc., may be obtained from Mr. L. A. Heath Humphrys, 13, Penywern Road, Earls Court, S.W.5, the hon. secretary of the society.

In addition, many enthusiasts may be interested to know that a considerable number of obsolete Festiniog Railway tickets are available for sale, and full details and particulars may be obtained from Mr. A. M. Davies, "Larkfield," Ash Lane, Hale, Cheshire, to whom applications should be forwarded, together with stamped addressed envelopes.

A great deal of work of all kinds on the railway has been carried out by voluntary labour, but there is still a great deal to be done, and any volunteers can rely on being found a job.

Pen Pals Wanted

MR. BERNARD LEAHY, 1208 Michigan Avenue, Saint Louis, Mich., U.S.A., writes in a recent letter: "Here is a thought that came to me the other day: The children in schools have pen pals in other countries; why not we model engineers? My forefathers came from Ireland; therefore, I would like to get to know some model engineers in that old country. I'll take on all callers that time will allow. Maybe, you can put this up to your readers."

Perhaps, some of our Irish readers would like to accept Mr. Leahy's invitation. More than once, in the past, THE MODEL ENGINEER has been the medium through which old friends, and even relatives, have been put in touch with one another after many years of separation.

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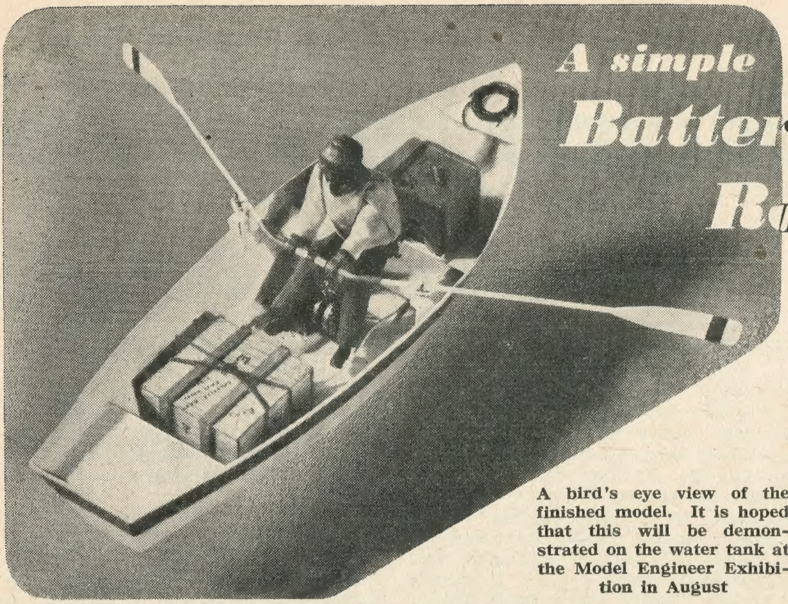


A simple Battery-operated Rowing Boat

By J. C. Hool

A bird's eye view of the finished model. It is hoped that this will be demonstrated on the water tank at the Model Engineer Exhibition in August

READERS will, I hope, be interested in the following notes on how to construct a comparatively simple model rowing boat that not only looks right, but has a most realistic and amusing scale action when the occupant is pulling away on the local pond.

The hull of the model was constructed on "dory" lines, using tin sheet, and I am giving actual measurements of the model shown in the photograph, though your own model may be scaled to suit your own particular requirements or perhaps to suit such parts of the mechanism that you might find in the junk box.

The Boat

The hull is made out of four pieces of tin sheet and the simplest way is first to scribe and cut out the bottom of the boat as in Fig 1A. The two sides *B* are formed from strips of tin sheet 14 in. long × $1\frac{1}{4}$ in. deep, one end of each strip being cut to give you the angle for the bow. These two side pieces are tacked in a "V" shape to fit the bow angle of the bottom of the boat, and are then tacked with solder along each side, working from the bow to the stern. You will find that, when you have finished tacking these side pieces at the stern, the hull has automatically taken a nice sheer. The overhang of the sides at the stern should then be cut off at a suitable angle so that the transom piece *C* may be soldered on.

The tacked seams should be soldered from inside the hull and breast hook in the bow, thwart, and seat astern soldered in place. The thole pins to take the oars are soldered one on each side to complete the boat itself.

I find it advisable to cap the sharp edges of the gunnel with tin strip of "U" section soldered on to the edge (Fig. 1D).

The motor which is housed under the dummy oil drum in the bow is one of the miniature types, $4\frac{1}{2}$/6 volt, readily available on the market, and is powered by two Drydex T10 cells, in parallel, these giving a working voltage of 3 volts. The battery is housed in the metal box in the stern sheets, and will propel the model for approximately $1\frac{1}{4}$ hours continuous running. If, however, the model is running only intermittently, and the cells are given the chance to recuperate between runs, the battery will last appreciably longer.

In the model shown the oarsman does 30 strokes per minute, but when making up your own model, the motor speed and worm reduction gear must be taken into account. By trying various voltages within the range suitable for the motor, you can find by trial and error the best scale speed for the rowing action. If the oarsman pulls away at a nice easy rate with slow, deliberate strokes as would his life-size counterpart, it is far more effective than having him shake himself to pieces and the boat going along at a "rate of knots."

The drive from the motor to the rowing mechanism is taken by a short length of rubber tubing stripped from a piece of insulated wire, and this drives the crankshaft by means of a worm and cog. The principle of the rowing movement is very simple. The crank pin operates a slotted lever which slides about a fixed fulcrum, this fulcrum being so positioned that the top of the lever, marked *A* in Fig. 2, describes a flat-sided ellipse when the crank is turned.

To make this operating lever not too obvious when the boat is in motion it should be constructed of, I suggest, $\frac{1}{8}$ in. transparent plastic. The lever has a piece of wire running through it at the top so that the oarsman's hands may be fixed on to it, and the motion carried through to the oars by means of two small pieces of flexible rubber tubing,

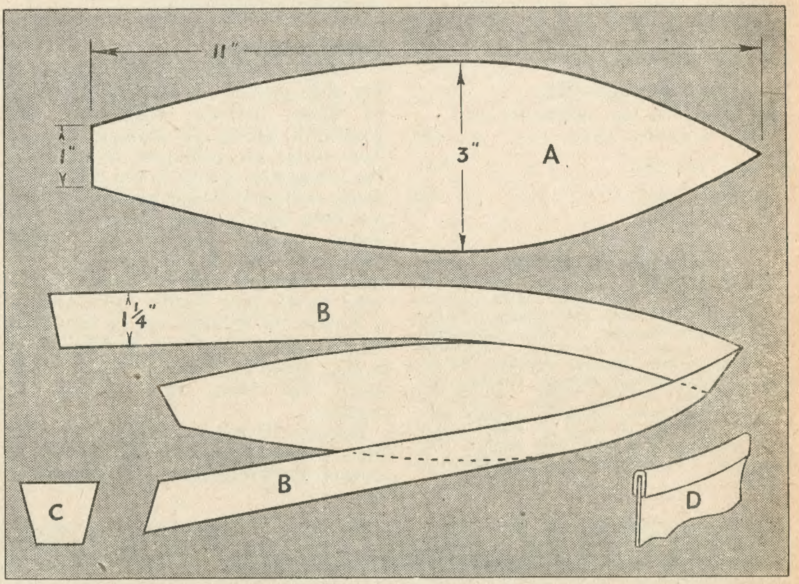


Fig. 1. Method of constructing the hull from tin sheet

this, again, being obtained from a piece of electric wire.

The oars (Fig. 3) are made of approximately 1/12-in. iron wire, on which tin blades are soldered. Small slotted pieces are soldered on to each oar so that the oars will hold on the thole pins and have approximately $\frac{1}{4}$ in. in which to slide on the pins. In the mid-stroke pulling position the blades should be inclined about 5 deg. from the vertical, this being desirable to give the blades a clean entry and pull out of the water at the end of each stroke—we must not have our oarsman catching "crabs"! By reason of the elliptical movement you do, however, get a slight feathering effect in any case.

Figure

The figure is carved out of wood in five pieces, as shown in Fig. 4, trunk and head in one piece, and arms and legs. The arms are wired on loosely straight through the man's shoulders, the hands being drilled to fit loosely on to the connecting wire at the top of the crank. Legs are also wired loosely at the thighs, the wire at each side being bent down to form two pegs which will fit into holes in the thwart to keep his body in position. When he is rowing his legs will thus be fixed on to the thwart and the rest of his body will pivot about the wire joining his legs. A figure of the size shown in the photograph is not an easy job to dress, but I have found that this can best be done, perhaps with female assistance, by cutting his trousers and jacket out of silk and, instead of using thread to join the pieces, sticking the seams with rubber solution.

Battery Compartment

On the model illustrated the battery compartment was bent up from a strip of tin and soldered directly on to the bottom of the boat. At one end of the compartment is an insulated piece carrying a strip of brass from which current is taken from the positive of the battery through to the motor, the current returning from the motor via the metal hull and battery compartment to the negative end of the battery. The easiest way to make a switch is to cut out a piece of celluloid or insulating material that can be interposed between the Drydex cells and the end of the battery compartment. To start the model, all you have to do is remove this isolating switch to close the circuit.

Painting I leave to you, but in the model illustrated the boat was painted in white cellulose enamel with red below the water line. The figure has dark blue trousers, light blue jacket, and a red cap.

To add to the appearance, it is as well to make a dummy case to go over both the motor and the battery compartment. You will find that you have a model that will create no end of interest and amply repay the short time required to construct it.

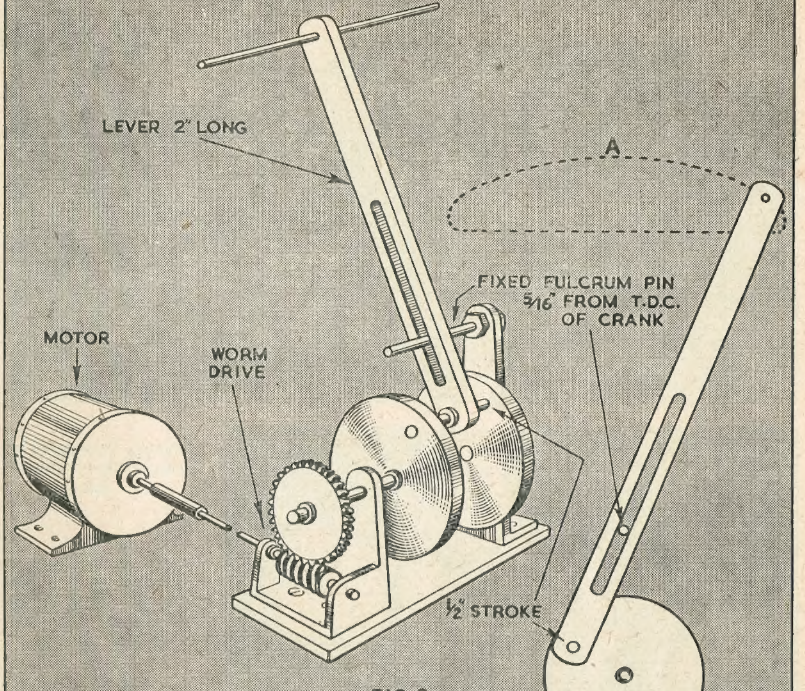


FIG. 2

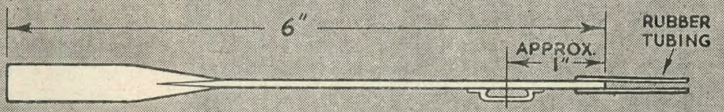


FIG. 3

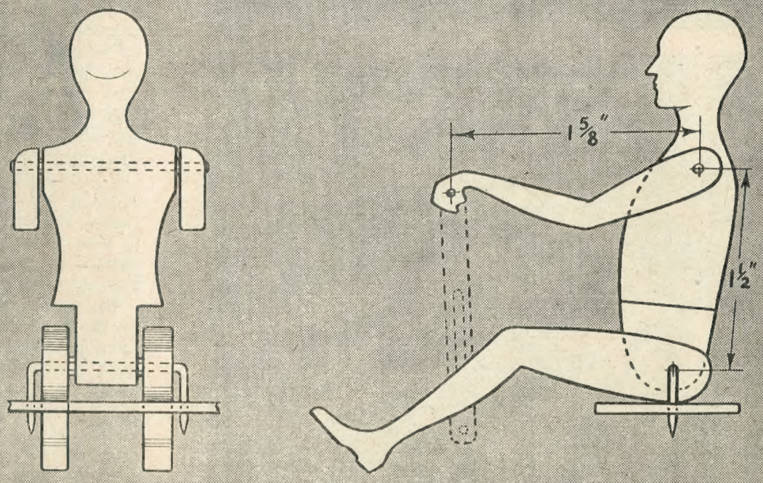
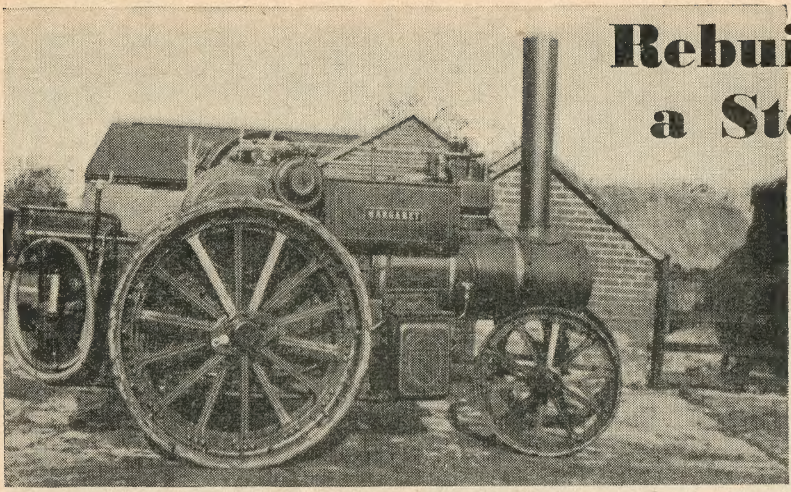
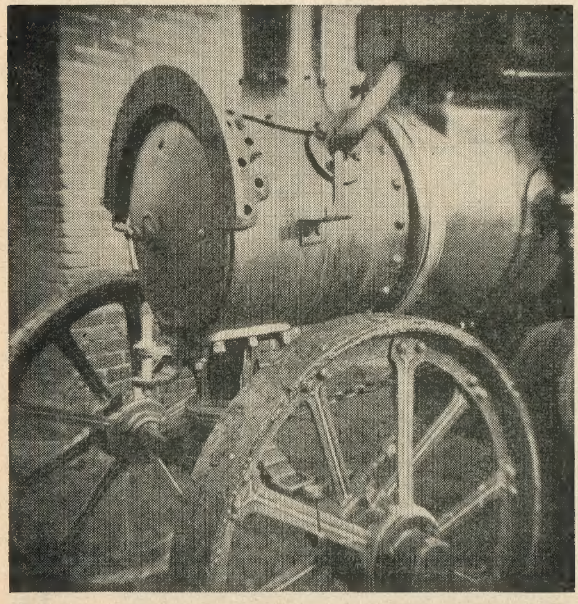


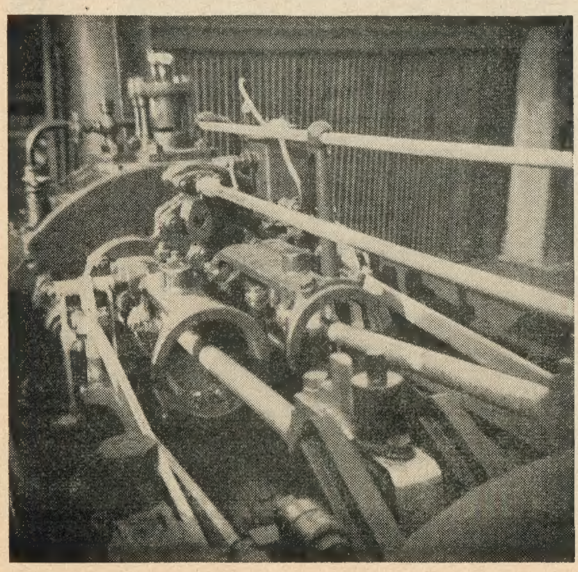
FIG. 4

Rebuilding a Steam Tractor



By L. N. Smith





Above: The engine on completion of rebuilding

Left: She was originally a roller. The casting for fitting the front roll can be seen in this close-up

Below: A close-up of trunk guides and valve gear

No "7898" is an Aveling & Porter G.N.D. Compound 5-ton steam tractor, of 4 n.h.p. She started life as a roller, so I had better say she is a "convertible." The casting for fitting the front roll can be seen in the close-up photograph. She left the Rochester works as a roller on February 19th, 1913. I hope the following will be of interest to all who read it.

I have always been interested in traction engines, and living on a farm all my life has given me the opportunity of seeing many of them in action, up till about 1946. After visiting some of the 1953 rallies, a desire to own and run an engine overcame me. I think I have travelled hundreds of miles to look at many different makes of engines; Burrells, Aveling, Fowler, Ransomes, McLaren, and a Garrett. None of these engines was suitable, so for some time I gave up the search; but the articles in THE MODEL ENGINEER by W. J. Hughes and others kept my interest in tractions alive. So I placed an advert in a weekly paper for an engine with a sound boiler-shell, and firebox. Then began the long journeys again; but nothing suitable arose from this, until a late reply to my advert arrived. In this, I was offered an Aveling 5-ton tractor, badly rusted, but with a good boiler, and best of all only about 15 miles from my home. I immediately phoned the vendor to tell him I would come and see it.

That evening when I arrived at his yard, I was surprised see a magnificent pair of ploughing engines, also a Burrell single-crank compound, and two other Fowler engines, together with Aveling No. 7898. The boiler seemed to be all he claimed; but oh ! that rust had indeed taken its toll over the 15 years that 7898 (as it will be referred to from now on) had lain under that hedge. Firewood was piled high on one side and a small elm tree had grown up through the final drive, and differential, emerging from a hole in the gear case ! I attempted to pull the flywheel round, but every moving part seemed to be rusted solid. The back cylinder covers were then removed to expose the pistons rusted in their bores. We then removed the manhole cover to show some very rusty tubes, but the rest of the boiler seemed in very good condition. A price was agreed on, and I arranged to collect the engine a few evenings later.

My friend, Mr. V. Halls, and I set out at a stately 5 m.p.h. on the Fordson Major, armed with a push-and-pull pole for towing. When we arrived, "7898" had been pulled out from the hedge and firewood with a crawler tractor as arranged. But it was found that the front axle pivot was also rusted solid. After much oil had been poured on it, we found we could just move the steering, but only with much exertion. We then removed the steering chains, and coupled the Fordson to one side of the axle by means of the push-pole. "7898" was jacked up by means of the push-pole lug, and the Fordson driven slowly backwards and forwards, for about 10 min., by which time, the axle had recovered its original freedom. After the chains were replaced, and the road wheels had been oiled, we started

for home. The journey proved uneventful, except for the amusement we seemed to cause the many onlookers. We managed to get home just before darkness fell.

From then onwards, almost all my spare time has been spent on "7898." The cylinder and valve-gear were dismantled, when it was found that the crankshaft could now be turned. Most of the rust was removed from the bores, pistons, rods, etc., but the valves and port faces were badly pitted, and many hours were spent with emery paste, before they were bright all over. After assembly, all oil cups were cleaned out, and fitted with new wicks; all glands were repacked. Safety and check valves were treated with very fine grinding paste, and a mechanical cylinder lubricator was fitted in place of the displacement lubricator.

Attention was next turned to the tubes. At the firebox end, they are held in place with a ferrule, and these had to be driven out from the smokebox end with a long bar. Then an attempt was made to drive out the tubes from the firebox end, of course. With a shouldered drift, and a 7-lb. hammer, they would not budge. So I called in the local blacksmith to cut each tube in half through the manhole with his gas cutter. The tubes could then be removed by forcing them upwards with a crowbar. It took 21 hours to fit the 27 new tubes, which are 3 ft. 9½ in. long by 1¾ in. diameter, swelled to 1⅞ in. at the smokebox end. To anyone who has never retubed a full-size boiler, and is contemplating having a go, I would say be prepared for some hard work, and I mean really hard !

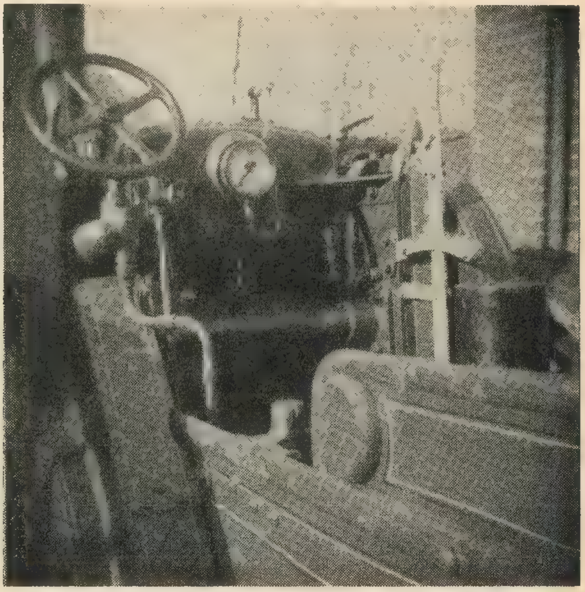
Next the final drive pinion was built up by electric welding, and as this has only 12 teeth, it was not a long job. Removing the hind wheel, gear-case and flywheel was a much greater task. The boiler feed pump was next removed, and found to be in very bad condition. I bored it out in the lathe and fitted a sleeve, then turned a new plunger. It was as I was refitting the pump that I got the idea of using it to give the boiler a hydraulic test (see diagram). An ex-W.D. pressure-gauge reading to 600 p.s.i. was temporarily fitted in place of the original gauge. The boiler was then filled through the filling plug on top of the cylinders, and a few gallons of water placed in the tender; the safety-valves were weighted down. Then Mr. J. Massingham, who had now come to my assistance, started to pump. It was not long before it was more than he could manage, so we placed one of the old boiler tubes over the handle, and together we pumped her up to 300 lb. p.s.i. Then we climbed down and looked round for leaks, but she was as tight as a bottle. After some time, we let the pressure down slowly by slacking the union holding the pressure-gauge until gauge showed 150 p.s.i., then the safety-valves were adjusted. The water was allowed to run out of the blowdown cock until the gauge registered half a glass.

At about six o'clock next morning, I raided the coal shed, chopped wood, and lit the fire. How nice it was to sit on the tender and watch the smoke drifting lazily skywards, not having to pump the tyre-pump like mad, as I have to, to raise steam in my "M.E." 1-in. scale traction engine ! Meanwhile, the oil cups and cylinder lubricator were filled. After about 1 hour, 5 p.s.i. showed on the gauge. When it reached 20 lb. p.s.i., I pushed the reversing lever, forward to the last notch, and opened the regulator, noting that the high pressure piston was about the centre of the stroke. Believe it or not, the crankshaft moved. I then opened the by-pass valve, and with the blast almost inaudible, "7898" began a new lease of life. When the gauge showed 80 lb. p.s.i., I put her in low gear, backed up to the water tank, and filled the tender with water. The rest of the day, which went all too quickly, was spent in driving up and down the drive. Sufficient practice was acquired to enable me to drive the engine into the shed in which it was to be painted, without damage to either shed or engine.

Several weeks were then spent in cleaning away the rust, Mr. Massingham tackling the brass with fine emery and paraffin followed by much Brasso. Then came the painting, first a coat of

(*Continued on page* 420)

Right: View from driving position, showing the controls



Below: View of engine from the flywheel side

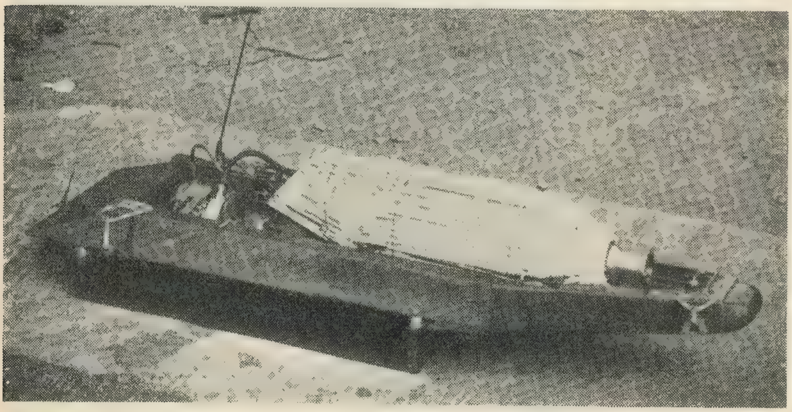
Experiments with Flash Steam

By J. A. Bamford

THE ratio of venturi throat area to jet area was calculated from an article on ejectors in a well-known technical journal, likewise the distance from the jet to the venturi. This device worked first time, and burnt through a mild-steel mock-up boiler casing. A visit to the local scrap merchant produced some thin stainless-steel sheet, and a new boiler was constructed using the four parallel coils of tubing from the old boiler. The casing was lagged with asbestos cloth and aluminium foil, this being a widely-used method of heat insulation. The first run of the boiler showed that it was very efficient, and that it made the most incredible noise. Probably due to the different sizes of inlet and outlet, it was working like a valveless pulse-jet, and the noise, which was a loud booming, could be heard a quarter of a mile away. The boiler was installed in the boat, and was then ready for the first static water trial; this was done in a small pond in the woods behind my house. Photograph 7 shows *Hero* as launched.

Catastrophe

I had hardly got the plant running when there was a blinding flash and I got a jet of burning petrol vapour straight in the face. I fled up the bank and the boat followed, roaring like a jet plane, coming 6 ft. up the bank, where it proceeded to dig a hole in the ground with its propeller. I realised that I was somewhat burnt, and hastily put the fire out by splashing water over it. I dumped the job in the shed, and drove down to the local hospital where I spent a somewhat pensive week, wondering how much damage had been done to my 400 hours' work. On escaping, I found that the petrol vapour pipe to the blowlamp jet had come unbrazed, a thing that had never happened before. Little damage was done, except to the propeller, which looked as if it had come off an aeroplane that had done a wheels-up landing. I replaced the faulty nipple with one of the swaged type, and took the boat down to the big pond, only this time I wore goggles and a face mask, as a burnt burn would have been really serious. In view of the obvious pressure in the fuel system, I had fitted an adjustable spring-loaded by-pass.



Photograph No. 7. "Hero" as launched

Having got the plant running, I screwed the by-pass down till I got the boiler booming as loudly as possible, and pushed off. The boat got away well, and boomed round at about 40 m.p.h. for three laps, then slowly tailed off till it was only doing about 5 m.p.h. I was very encouraged by this performance, and proceeded to adjust water flow and blowlamp; but, try as I would, it would not do more than about three laps at a decent speed. On one run the boat suddenly stopped with a loud hiss and, on examination, the turbine was found to be immovable. The brass nozzle had parted, and been propelled down its tube under a pressure of over 1,000 p.s.i. into the rapidly moving wheel. I had to drift the wheel out after heating the casing, and turn off the brass that was welded to the buckets. No damage was done, except to the replaceable insert ring in the case that had been put there to cope with such an event.

A new nozzle of stainless-steel was made, and several more fruitless attempts were made to work up the speed. I decided to make a new boiler, there being two reasons. No. 1 was that I had two bursts, and the tube, which was two seasons old, was obviously getting thin. The second reason was that, in spite of the lagging, the hull was getting burnt. I made a new boiler casing smaller than the previous one, and re-designed the tube layout inside.

Fig. 2 shows in internal economy of what I consider to be the most successful boiler I have yet made. It does not make the noise of the first one, but it evaporates over two pints of water, and uses even less petrol than before. The exhaust gases come out only just hot enough to blister paint, and the steam pressure is approximately 2,000 p.s.i. The only snag is that it burns through boiler tubing at such a rate as to make the purchase of some stainless tubing an absolute necessity. A great deal of work was done, mainly on steam nozzles, but little difference could be made to the performance. I was thus faced with a problem: which was at fault, the turbine or the boiler? I had a good idea that it was the turbine, but I could not be sure until I had tried the boiler on a conventional type of engine.

A Piston-valve Engine

I therefore resolved to build a very conventional type of piston-valve engine, so that a direct comparison could be made. Before commencing this project, however, I tried an experiment that I had been thinking about for a long time. I wanted a method of converting the high pressure steam that is essential for boiler efficiency, into low pressure steam which the turbine could use more efficiently with full peripheral admission. The idea was to use a steam-to-air ejector as a mixing device, and use the low pressure large volume mixture, in an inward radial-flow turbine, rather like a centrifugal compressor run backwards. Fig. 3 shows the principle of the ejector. The air would be drawn from the blowlamp exhaust, and would thus help to keep the steam dry after it had been expanded through the forcing nozzle. The device was designed, using the same information as for the blowlamp. However, this time I had to do some guessing, as the article did not cover driving pressures as high as mine. I calculated that I should want about 7 lb. per sq. in.

Continued from page 379, April 7, 1955.

on a $\frac{3}{8}$ in. dia. hole to provide enough "puff" to produce 3 b.h.p. from a turbine working at 70 per cent. efficiency, which is what this type of turbine is reputed to achieve.

I set the ejector up in the boat, and fed fuel and water by hand. Photograph No. 8 shows the ejector fitted in the boat. With lots of frantic pumping, I managed to get about 4 p.s.i., and for a fleeting moment managed to get 6 p.s.i. Remembering the effort required to get half a b.h.p. by hand pumping the piston engine, I was not displeased, and I think that, using power-driven pumps, my target of 7 p.s.i. could have been achieved. To use the output from the ejector, I will have to build a new turbine capable of using the large quantity of low-pressure gas.

This type of turbine has several advantages over the simple impulse type; as it uses low-pressure gas, its nozzle speed is lower, and thus the wheel tip speed is much lower. A single stage gear reduction of higher efficiency can be used, but the most important advantage is the greater safety due to the lower speed. However, this project must wait till the piston engine is fully developed and I know my boiler performance is satisfactory.

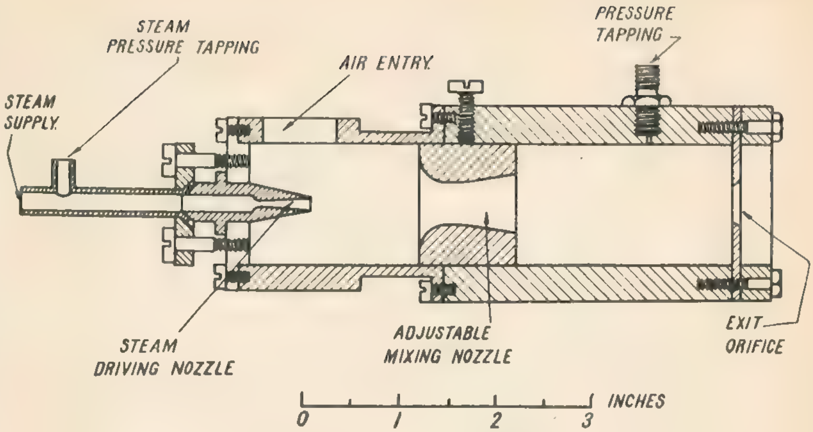


Fig. 3. Steam to air ejector

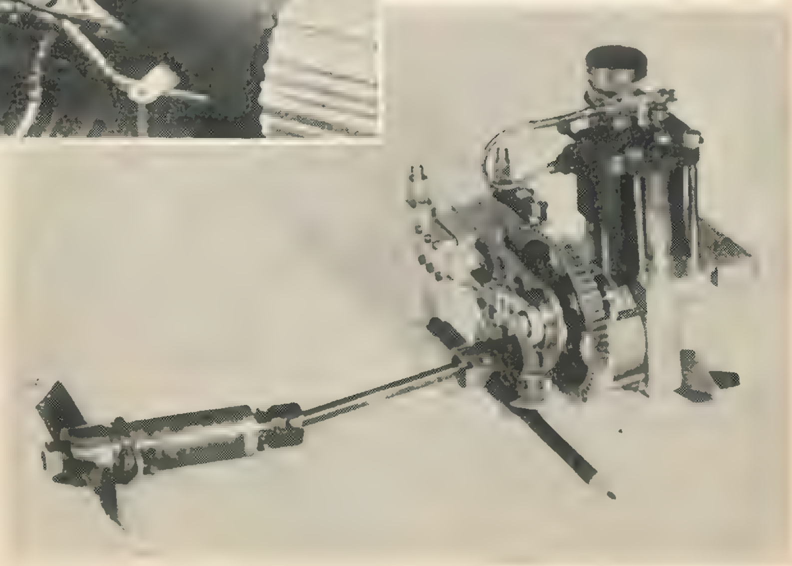
Photograph No. 8. Steam to air ejector on test in "Hero"

Merits of Conventional Design

A design was next drawn up for a conventional piston-valve engine of simple, but robust proportions. An article only becomes conventional because it has been proved over a long period as the best. The bore and stroke dimensions are $1\frac{1}{8}$ in. $\times$ $1\frac{1}{8}$ in. The capacity may seem large, but I wanted to use a short cut-off and expand down to as low a pressure as possible. As events later showed, I have reasons to believe an even bigger engine could have been used, but the weight problem then rears it head.

The engine, which is shown sketched in Fig. 4 was built in about two weeks, in the middle of the 1954 regatta season. The crankshaft is machined from the solid, with a screwed-on balance weight. A ball-race big-end and dural connecting-rod were fitted, and the aluminium piston had one ring to begin with. The cylinder and piston valve were made from cast-iron, and the cylinder-head and valve chest were made from high tensile steel. The valve is driven by a simple eccentric attached to the flywheel collet, and is thus adjustable.

It was intended to use the pump gear from the turbine, so the crankshaft was made long enough to carry the pump drive gear, as originally fitted. It will be seen that the crankcase, as such, was made from a piece of dural angle, and thus the big-end can be seen whirling round. This is a big advantage from the condensation point of view, but it makes a fearful mess and is due to be modified. The valve timing was the subject of some experiment and I



Photograph No. 9. The conventional piston-valve engine

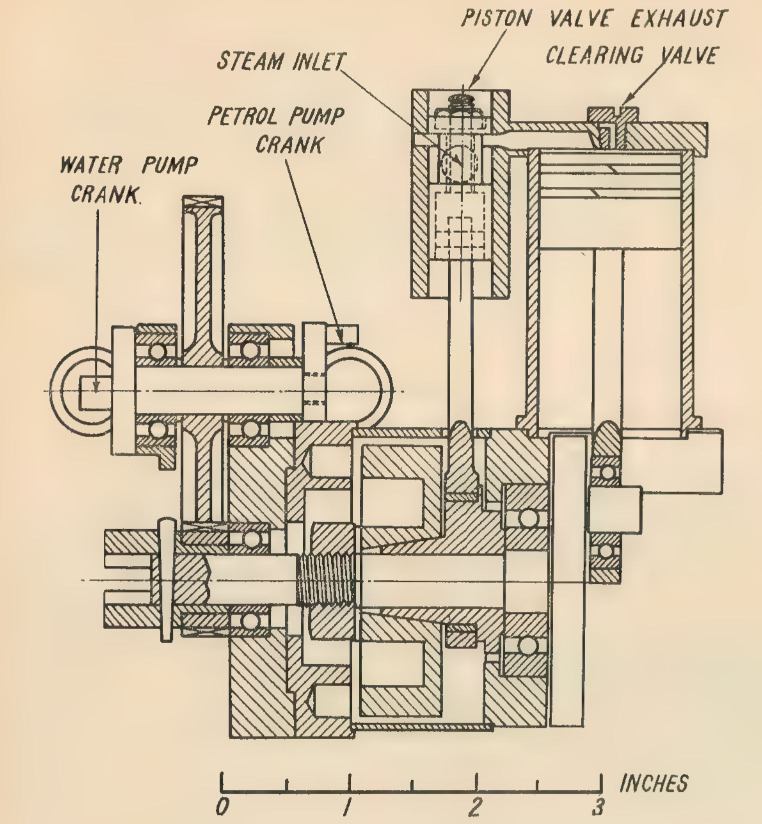


Fig. 4. Section of conventional piston-valve engine

started off by using about 75 per cent. cut-off. Subsequent reduction in the cut-off brought an increase of power with each reduction, until I thought that if I went any further I should suffer from port strangulation. Fig. 5 shows present valve timing, and Photograph No. 9 shows the complete engine.

The first time I ran the engine it was the usual static test, and it had only been running for a few seconds when it suddenly revved up to astronomical speed. I hastily shut down, and found that the universal joints in the propeller shaft had disintegrated. Obviously, the snatchy torque from the big single cylinder was too much for them; for, although the mean torque may have been no more than the turbine, the torque on the power stroke must be terrific. I then made some huge joints, $\frac{7}{8}$ in. dia. with $\frac{1}{4}$ in. cross pins. These have withstood all further onslaughts, and have bent up several really strong propellers. No real trouble has been experienced with the engine, and, apart from adding one more piston ring, no modifications have been done.

A Lubricator Improvement

At one period, however, I had the feeling that the engine was running short of oil, so I built a lubricator 50 per cent. longer, and incorporated a rather useful mod. at the same time. It will be seen from Fig. 6, that the oil exit is below the top of the cylinder, and that the floating piston can rise above this port. When this happens, the feed-water is allowed to enter the steam pipe *via* the oil pipe, and the plant stops. No trouble has been experienced with water in the engine, and no seizures due to lack of oil have occurred since this lubricator was fitted.

It will be seen that the floating piston, which is quite a loose fit, has an internal passage to allow all the oil to be expelled from the cylinder. At one time, I ran out of steam oil, and used oil supplied for use in motor back axles. Apart from the peculiar smell, the results were entirely satisfactory, and the engine is easier to turn when cold. However, steam oil was not compounded for nothing, and I intend to use it in the future.

A certain amount of trouble has occurred in the pump department, mainly to the drive gear. The $\frac{1}{4}$ in. wide bronze gear-wheel that was fitted to the pump assembly on the turbine, only lasted a couple of runs before the teeth all leaned over backwards. I found a steel gear $\frac{3}{8}$ in. wide that formed the dynamo drive in a motor-cycle magdyno., and from the scrapbox came a small gear that meshed perfectly with it. These were fitted, and entailed building a completely new pump assembly. However, no further trouble has occurred, and if I do get any I shall be very surprised, as the gears used are quite out of proportion to the job that they are generally supposed to do. I say this, because at a later date I measured the steam pressure and got quite a shock.

Petrol Pump Trouble

Several quite fast runs were made, with speeds up to 55 m.p.h. for about three laps, but the plant always died before the full five laps could be achieved. The trouble was eventually traced to fuel starvations due to vapour locking, and was partially cured by using a 50/50 mixture of petrol and paraffin.

At one period I had a lot of trouble pumping petrol, and had valve trouble on the pump. I tried ball valves, disc valves, mushroom valves, valves with neoprene seats, valves with P.V.C. seats, until in desperation I made an entirely new pump using conventional ball valves. To my astonishment, it worked perfectly first time, and has

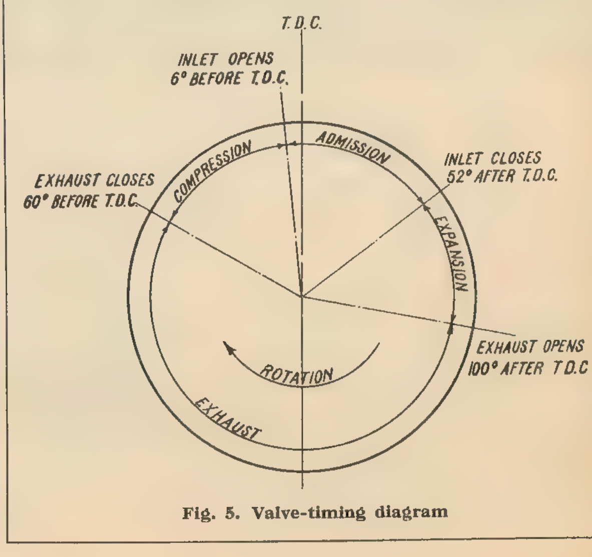


Fig. 5. Valve-timing diagram

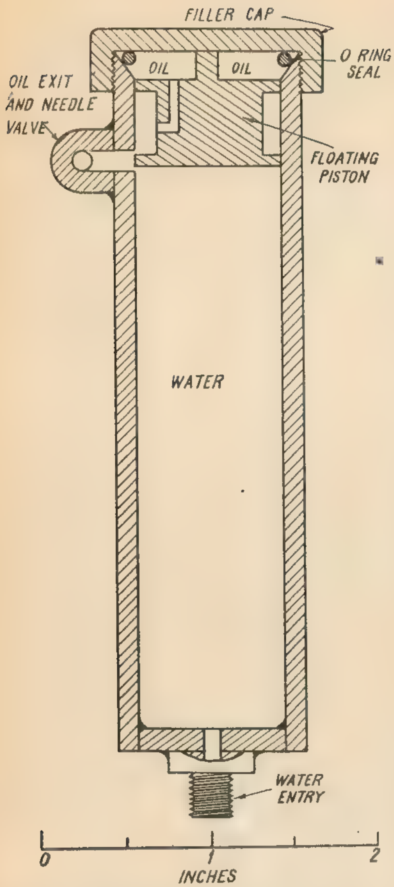


Fig .6. Modified Pilliner-type lubricator. Sketch shows lubricator empty and by-passing water to engine

never given any trouble since. That is the way this power boat game goes, and I often wonder how the old hands have kept sane all these years. After having got the pump working, another trouble reared its head.

After pushing off, the boiler would appear to go out, and the boat would circle for a couple of laps on the residual heat in the boiler, and then suddenly the lamp would cut in with a roar and 50-55 m.p.h. would be recorded. However, this is of no use in a regatta, and I regret to say that up to the time of writing, I have not cured it. I feel it is a case for the wind tunnel, but as the hull is all wood, I am very reluctant to risk burning it to a cinder, and this hull is not yet ready for a "Viking's" funeral!

A Fascinating Pastime

All these snags make flash steam a very fascinating pastime, and as each one is eliminated, one is nearer to the day when the engine works, the blow-lamp does not blow out, and the hull is capable of handling all the power the engine can muster. It would appear that this happy state cannot be reached, as a powerful engine breeds hull trouble, and a good hull breeds engine trouble!

Towards the end of the season, the boiler began to suffer from burst tubes, and I had to pipe the hot end with $\frac{5}{16}$ in. × 17 S.W.G. tubing. This led me to check the pressure in the boiler, so a 1,000 lb. gauge was connected to the water end, and the plant started. I was somewhat dismayed to see my precious 1,000 lb. gauge whizz round to and beyond the 1,000 mark. I shut down and took the gauge to pieces. It was ruined, and the Bourdon tube was somewhat swollen, so the pressure must have been in the 2,000 lb. region. I managed to borrow a small aircraft type gauge that had a maximum of 4,000 lb., this being attached with much more confidence than that with which the last one was removed. I again steamed up, and was really astonished to record a pressure of just over 3,000 p.s.i. I could not get the exact figure, because the gauge needle "buzzed," this being due to the water pump pulsations. However, the pressure was held for about 45 sec., and that is as long as I cared to run the plant in a static condition. It is quite evident that one must get a certain amount of mechanical trouble when working with such high pressures, and I have every reason to be satisfied with the mechanical reliability so far obtained. The Achilles' heel is still the blowlamp; or rather the petrol supply to it, and ways and means must definitely be found of curing the trouble.

I must refer again to the use of gear oil, as all the recent testing has been done using this type, due to running out of the genuine article. Apart from the appalling smell, I find it every bit as good as steam oil, and it is much more consistent in its viscosity, as it is never as thick, and consequently eliminates fiddling with the oil supply valve between runs immediately following one another.

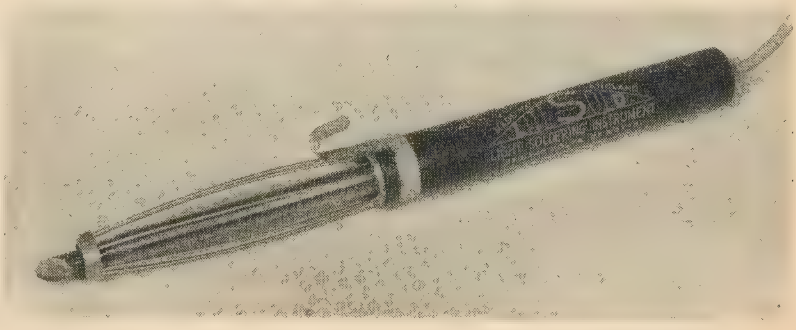
Well, folks, there it is, and I shall be very happy to receive suggestions and even happier if I have inspired anyone to build a flash steamer.

A NEW ELECTRIC SOLDERING IRON

WE have recently examined and tested out a very interesting light soldering appliance submitted to us by Light Soldering Developments Ltd., 106, George Street, Croydon, Surrey. This device, registered under the trade name "Permabit," is made to suit a wide range of voltages from 6-7 volts up to 230-250 volts, and with bit sizes from $\frac{1}{8}$ in. to $\frac{3}{8}$ in., fixed or replaceable, consuming 12 to 40 watts.

The bits are made of a special alloy which, while having a heat conductivity only slightly lower than that of pure copper, are claimed to be specially resistant to wasting or pitting, so that they last indefinitely and, having once been tinned, do not require subsequent filing or re-shaping. A wipe with a clean cotton rag is all that is necessary to remove dirt or tarnish. Heating-up time on rated voltage is approximately one minute. An ingenious attachment to the bit is a heat guard of chromium-plated spring steel wire, which serves not only as a protection to the hands, but also avoids damage to rubber insulation or other material with which the bit may come into contact. The appliance is designed specially for use in the radio or electronic industries for delicate wiring operations, but it also has an application for many kinds of model work, and particularly where space is limited and access difficult.

On account of its low voltage consumption, it is not suitable for operations on heavy material, as the heat reserve is small; for such work, much higher input wattage is essential. For parking the bit when not in use, a safety shield can be supplied, in which it can be hung by the hook provided on the handle, out of the way, but always within reach.



The "Permabit" miniature soldering bit, with heat guard in position

MAKING SMALL BUTTON DIES

By "Quidnunc"

I EXPECT there are many readers who have examined small button dies and considered that they are not worth the trouble of making, when one can buy them for 3s. to 6s. each according to size, but being an individual who is prepared to try anything once, I set about making a set from 6 B.A. to $\frac{5}{16}$ in. Whitworth, and, though they occupied my time for several evenings, the result was equal at least to the commercial variety.

Until a complete set was placed side by side on the bench, I am afraid I did not know how different they all were—a case, I must admit, of using them literally hundreds of times with my eyes shut.

For instance, I did not know until I examined each size independently that the cutting edges varied from three to six—I was aware that three was a very common number, but I thought eight edges were provided in the large dies. Once I had started the investigation and made a few sketches, I knew I must make something of this sort just to satisfy my curiosity, and I have shown an elevation of each type as a guide to others who may care to try the same experiment.

The first point to consider was the material from which to turn the dies—I knew they were made in the large engineering tool rooms from non-shrink steel, and I was fortunate in securing a suitable bar through the kind assistance of a friend engaged on identical work, and who looked upon this enterprise with some doubt and more than a little amusement. However, the steel I used was Kayser Ellison Extra Quality Low Alloy Carbon Steel, a material which, if hardened correctly, gives a die of fine cutting qualities that will cut a perfect thread.

The piece I had came to me already annealed, so I set it up in the four-jaw chuck and skimmed the outside diameter to $\frac{13}{16}$ in., chamfered both the edges, centred and then drilled it for about $\frac{3}{8}$ in. deep some 10-thou. smaller than the core size. To make sure the holes rotated truly with the outside diameter, the surplus was removed with a boring tool—some three cuts being taken to bring it to the correct dimension. For those not acquainted with the art of toolmaking, perhaps you will find it more convenient to leave two or three thousandths in the hole, and then a perfect, full thread is produced.

Now comes the most important process—the tapping of this hole. There are three ways of carrying out this work—by manipulating the tools while the die is still attached to the bar; by cutting it off and using a drilling machine to pilot the tap; and again to part off the blank and set it up truly in the chuck, and follow this by running the tool through the already drilled hole.

I have a small three-jaw chuck which has jaws that are above suspicion, so I reversed these and pressed the slice of steel back against the steps—taking particular note to see that any dirt or swarf was cleaned off before finally tightening the jaws.

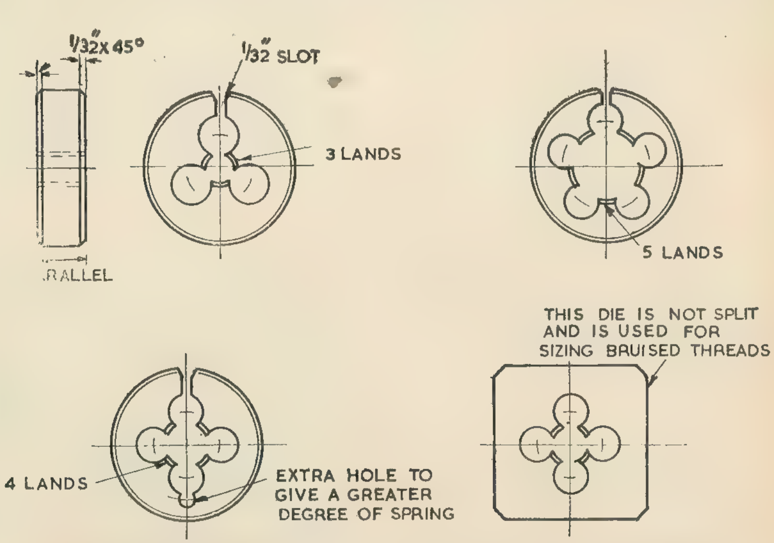
For those who know the equipment will never produce this perfect concentricity, a brass bush recessed to make a seating face for the die when pressed back in the same manner as described above is just as effective.

Tapping is one of those operations which requires perhaps a little more than the ordinary care associated with this work. To make sure the taps are cutting properly and to size, I suggest you drill and tap a trial hole in a piece of soft steel or brass and check it with a screw which measures to within 0.0005 in. on the outside diameter. Having satisfied yourself that your taps are in first class condition, finish off each hole before removing the die from the chuck. A female centre is an asset for the smaller tools to ensure they enter the hole parallel with the axis; similarly the orthodox male member is useful for the $\frac{1}{4}$ in. and $\frac{5}{16}$ in. Whitworth taps. Never pull the belt round and let the tap pass through, as there is a danger of an oversize hole being produced, or perhaps you will find on later examination the finished thread is very slightly "drunken," as we say in the machine shops.

Ease the tools through the bore—this is the best way to describe the operation, because it signifies that care is essential, and only about a sixth of a turn is imparted to the tap before the rear centre is again moved forward in support. Use cutting oil as a lubricant, and for at least the first tap, keep the flutes clear and so prevent any tiny piece of steel's becoming lodged in the threads—a possibility that can cause torn threads and so ruin the die. When this operation is finished, countersink both sides about one thread deep—a little more, possibly, for the larger varieties, but for the B.A. members one thread is sufficient. Run the plug tap through again to make sure the burr created by this latter process is entirely removed, and then the die is ready for the drilling of the "land" holes.

A close degree of accuracy is not necessary for this stage, but I do advise care, because this is one of those occasions where a slight error shows up like a set of traffic lights at night. If the holes are not true with the threaded portion, the error will look considerably worse than it really is—an annoying illusion which makes your workmanship suspect, so try and mark them out to avoid anything of this nature occurring.

You can, if you wish, make a small screwed plug for insertion in the tapped hole, and use this to locate the scribers. Strike a circle and divide it up with a protractor, or, alternatively, step the divisions off with a pair of dividers



Drawings illustrating three different types of circular dies, and a square member used principally for the correction of bruised threads. No form of adjustment is in this case provided

Centre-punch each intersection, and the article is then ready for drilling.

Another way of marking out these land holes, if you possess a suitable pair of odd-leg calipers, is to apply them carefully from the outside diameter—scribing a short line where you wish the intersection to come; I prefer the previous method, however, as I find this latter gadget is not so easy to use.

Now drill the holes, and for this operation sharpen the cutting edges, as the holes must pierce the die and emerge at the other side without any sign of wandering from the true path. Do not apply excessive pressure, but allow the drill to cut easily, using any type of lubricant in generous quantities. I would advise all readers to clamp the discs down on the drilling machine table or against an angle plate set up on the lathe cross-slide; by this means you can ensure the drill is square before work commences. Holding the parts in a vice needs attention in setting up, but with the aid of a small finger clamp to hold the dies on to the table, the holes must enter square with the faces.

Clean out the threads. You cannot do this with an ordinary tap, because the flutes and lands will not allow you to rotate the tap, so use a screw, preferably one of the socket-head variety, and ease it back and forth. You may find it a little tight, but with patience the burrs are soon cleared away. Scrape off the sharp edges from the land holes, to prevent their cutting you at some future date, and then mark a line where you propose to split the die.

A hacksaw is the first tool that comes to mind for this work, and for such a minor operation, I agree, it cuts the surplus in a matter of seconds. However, I took the trouble to attach a thin saw to my milling machine and used this instead—it gave a cleaner slot, and once the saw was in position, I milled a dozen in ten minutes. You can file the taper at the top of each split where the adjusting-screw contacts—a thin half-round file being the most convenient for this purpose.

Hardening was next attempted, and I will admit that I was not at first too happy about this process. I have frequently heat-treated different pieces of steel successfully, but I knew that this was an operation undertaken by an expert in the large heat-treatment shops, and it needed careful handling.

I have no instruments to tell me the temperatures of a piece of heated metal, so I must necessarily rely on my eyes and endeavour to judge the hardening colours as old engineers did in days gone by. I hunted up a colour chart and noted that for 750 deg. C., I required to heat the dies to a cherry red—the heat and colour for the above-mentioned piece of Kayser Ellison steel. I was also told to heat them slowly, so I let my flame run over them for several minutes before increasing the blast. I carried this out in stages, and I suppose it took about 10 min. for the die to attain the appropriate degree of heat. The parts were then plunged vertically into a can of clean water, and agitated with a stirring motion.

On examination, they appeared satisfactory—at least they hadn't cracked—so I then started to temper them to relieve any severe stresses in the metal caused by the heat treatment.

For this stage, a temperature of only about 250 deg. C. is necessary, so I placed the dies two or three at a time on a steel plate and gently ran the flame over each member, turning them round at intervals. A temperature of 500 deg. shows a dull red heat which is just visible to the eye in a fairly dark corner, but as I needed only half this temperature, I had to guess when that heat had been reached.

On reflection, I have no doubt that I was probably a long way out in this estimation, but it speaks well of Messrs. K.E. steels that the dies eventually gave satisfactory results.

After a clean-up to rid the pieces of the hardening scale, a tryout was then indicated, and I tried each die separately against a commercial tool in this manner.

I set up the latter in a tailstock holder, and by a process of careful adjustment, eventually managed to get it to cut exactly the required diameter; each cut being subjected to a check by the micrometer. Next another screw was cut, this time using the home-made tool, but I did not disturb the commercial die in the holder; as I needed this correctly set for my purpose. Another holder was applied, and when I was satisfied the tool had produced the best thread possible, I replaced the commercial tool in the tailstock and used this as a gauge. I watched very closely to see whether, on slowly turning the headstock spindle, the cutting edges would remove any material, and I was gratified to note that, other than a mere scraping which was only just visible, both dies were identical.

This showed me that little if any distortion had taken place; in fact, for all I knew, the errors may have been in the commercial dies and mine were correct. I bow to the bought article only because I could not carry out a closer check, and I am admittedly an amateur at the work—the result, however, convinced me that in future I shall make more of these tools when I consider an "odd" thread necessary. They look difficult to make, but if you take particular pains to see the threads are square with the faces and concentric with the outside diameter, then you have already overcome the most awkward part, and the rest of the operations are just routine.

One further comment. Do obtain a piece of suitable non-shrink steel for taps and dies; metal that distorts and shrinks is useless for accurate tool work of this nature, and you are merely wasting valuable time with such material.

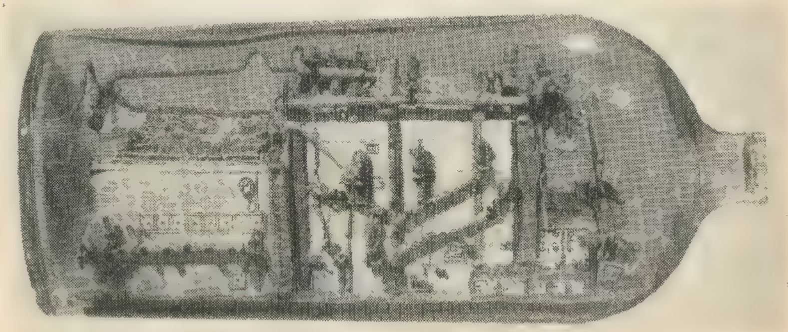
Some readers may consider it necessary to add the dimples for the adjusting-screws—I never think they are worth while, but stamp the sizes on the faces, and so save yourself many valuable minutes endeavouring to ascertain the diameter and number of threads per in.

A BOTTLED BOILER

THROUGH the courtesy of Mr. E. B. Watton, Press Officer, Babcock & Wilcox Ltd., we reproduce a photograph of a "bottled" model of a Babcock boiler. Externally, the model is complete in every detail, but unfortunately, the quality of the glass of the bottle is so poor that, from whatever point the model is seen, the distortion is very bad.

There are probably thousands of ship models in bottles, and other subjects have been similarly mounted in recent years; but we do not recall having previously seen, or heard of a boiler installation treated in this way.

This model is kept at the Glasgow office of Babcock & Wilcox Ltd., and is thought to be at least twenty years old. We understand that it was made in strips and inserted through the neck of the bottle by means of a pair of bamboo tongs.



QUERIES AND REPLIES

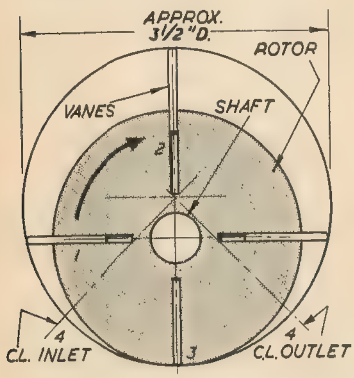
"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Vane-type Compressor

I wish to construct a vane-type compressor and propose to use a cylindrical casing approximately 3½ in. internal diameter by 3 in. in length. If you think this is suitable, will you please suggest some of the other dimensions which will be necessary.
(1) *diameter of shaft,*
(2) *thickness and depth of slots; suitable material,*
(3) *clearance between rotor and casing at the narrowest point,*
(4) *position of inlet and outlet for maximum pressure of vacuum.*

E.A.H. (London, S.E.1.)

(1) A shaft of ½ in. diameter would be suitable for transmitting the power necessary to drive the blower, and also for supporting the rotor properly in its bearings.



(2) The thickness of the vanes does not have any direct bearing on the efficiency of the compressor, but if it is to be run at fairly high speed, they should be kept as light as possible, and we suggest that vanes made of phenol-bonded plastic material, such as Tufnol, about 3/32 in. to ⅛ in. thick, would be suitable. The slots should be cut as deep as possible without unduly weakening the rotor or affecting its secure fitting on the shaft.

(3) The rotor should be in running contact with the wall of the outer casing at the point indicated on your drawing. In some cases, the casing is actually machined to produce a seating concentric with the rotor, so as to improve the seal at this point.

(4) The position of the inlet and outlet ports in the casing should be as close as possible to the point of contact between rotor and casing without actually introducing a restricted area of opening. If the ports are arranged at about 45 deg. to this point the results will be satisfactory, both in respect of volume and pressure, though for extremely high efficiency, some modification may be found desirable.

Incidentally, you do not mention one of the most important features in the design of the compressor, namely the relation between the diameters of the rotor and casing. For obtaining the maximum output, this should be as great as possible, but in actual practice, it is limited by the necessity to provide adequate bearing for the vanes when they are fully extended. A difference of ¾ in. in the diameter of the rotor and stator, making the latter 2¾ in., is as large as could safely be used, and less than this would be generally desirable.

The running clearances between the ends of the vanes and rotor, and the end plates of the casing, should be as close as possible.

Colouring Metals

I am using aluminium alloy in the construction of several pieces of photographic equipment, and I shall be very grateful if you can refer me to any information on how to blacken the surface of this metal by chemical means. Anodising is beyond my capabilities.

W.P.R. (Trowbridge).

An article on "Surface Treatment of Metals" appeared in the issue of THE MODEL ENGINEER dated November 5th, 1953.

Working Perspex

I wish to make some small parts in Perspex, and shall be obliged if you will give me the following information :—
(1) *Is it possible to buy this or similar plastic material in rods of diameters from ¼-in. to ½-in.?*
(2) *What tools are used for turning Perspex, also coolant required and cutting speed?*
(3) *Is it possible to bend the material to any desired shape?*

K.Y. (Huddersfield).

(1) This material can be obtained from Messrs. Lawrence & Jefferys Ltd., 16, Gloucester Road, Brighton, Sussex, in rod or sheet form, and in various sizes.

(2) Perspex can be turned in the lathe by using tools somewhat similar to those used for turning brass, and at similar speed. Generally speaking, no coolant is required unless very high rates of production are necessary, in which case, thin soluble oil emulsion may be used.

(3) Perspex can be bent readily to any required shape by heating it either dry or in water, to a temperature just under boiling point.

Metal Finishes

Having occasion to turn out some lens mounts in dural, I referred back to an article by C. G. Green, A.M.I.M.E., in THE MODEL ENGINEER, *No.* 2721, *Vol.* 109, *and am very interested to know that the M.B.V. solution is the one he used to produce a durable dark finish. I should, therefore, be pleased if you can tell me of this, or of any other method to achieve the same result.*

N.S.W. (London, S.E.12).

We draw your attention to the article you quote in the November 5th, 1953, issue of THE MODEL ENGINEER, particularly the second paragraph on page 557, where your queries are answered.

Any further information can be obtained from: The Waterisation Co. Ltd., Purley Way, Croydon, Surrey.

Next Week . . .

LATHE CONSTRUCTION

The first half of a two-part article in which a reader describes how he built his own lathe.

AUTOMATIC FEED

"Duplex" describes the construction of an independent motor-driven device for traversing the lathe saddle.

MODELLING MACHINE TOOLS

Following up an earlier article on old-type machine models, Mr. F. Surgey now describes some interesting models of modern equipment.

COOLING SYSTEMS FOR I.C. ENGINES

The construction of a miniature radiator for closed-circuit water circulation applicable to a marine petrol engine.

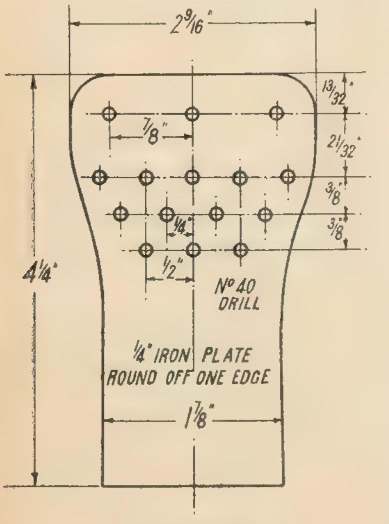
N.A.M.E. EXHIBITION

A preliminary review of the Northern Models Exhibition recently held in Manchester.

L.B.S.C.'s "Netta"

BOILER FOR THE 3½-in. GAUGE ENGINE

THE odds are about a million dollars to a pinch of snuff that no builder of the 2½-in. gauge *Netta* has the boiler ready for staying; so there is neither sense nor reason in making the builders of the larger sizes wait while I give further instructions for the smaller one. Also, as the staying job is what the kiddies call "much of a muchness" on all three locomotive-type boilers, I can deal with the lot at one fell swoop, saving time and space. I therefore have pleasure in presenting another of my examples of "definitely bad practice" (ah ! now did I hear somebody laughing ?) which has stood the test of time, and proved its efficiency on the track under any condition of service. As the method of construction of the 3½-in. gauge boiler is practically identical with the smaller version just described, there will not be any need to go into full detail. I have tried to make the drawings as clear and as simple as possible, and a few brief notes should enable our friends of the 3½-in. gauge, to go ahead.



Firebox former

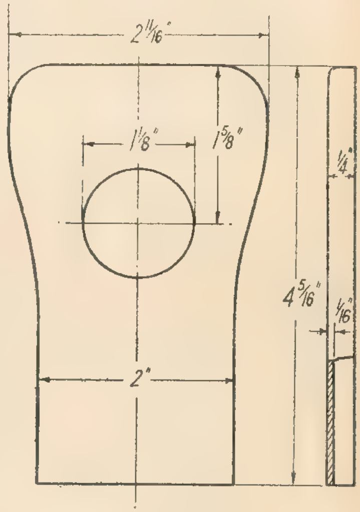
By way of variation, I have shown the boiler shell made up from a combination of tube and sheet material. The barrel can be made from a piece of seamless tube, saving the trouble of making and brazing a longitudinal seam. The wrapper is bent up from sheet copper, and attached to the barrel by a "piston-ring" joint, which is really a single butt joint with the connecting strip inside the boiler, extending around the barrel from one throatplate flange to the other. The firebox and tubes are on the same principle as the smaller edition, but there is room for three superheater flues and twelve ordinary tubes. The stays are the same size, set at the same spacing. This boiler will naturally need more "therms" to braze it up, and a five-pint blowlamp or an equivalent air-gas blowpipe will be required. For the lucky folk who possess, or have the use of oxy-coal or oxy-acetylene equipment, I'll add a note or two, on my own way of doing the job.

Boiler Shell

The boiler barrel is made from a piece of 16-gauge seamless copper tube, squared off at each end in the lathe, to a length of 11⅜ in. To square off, I usually grip one end in the three-jaw, putting something inside the tube to prevent the jaws distorting it when it is gripped tightly enough to prevent it flying out. A wood plug is knocked into the other end, centred, and supported by the tailstock centre. A bent-ended round-nose tool, plus a drop of cutting oil, will then do the needful in two wags of a dog's tail; or a straight-ended round-nose, set on the slant, will do just as well.

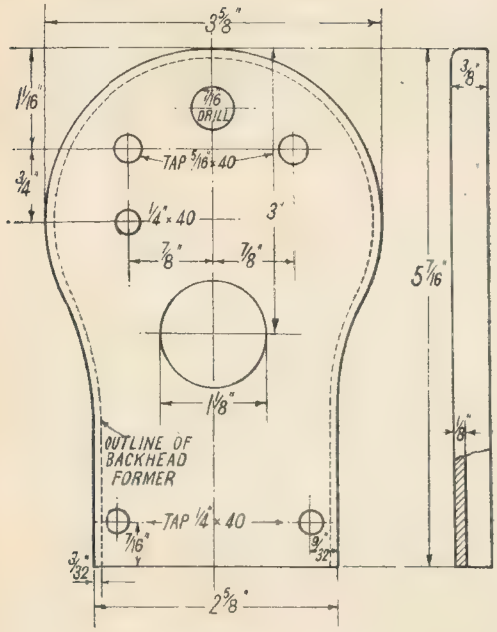
The firebox wrapper, being round-backed, can be made from a piece of 16-gauge sheet copper measuring 5½ in. wide by approximately 13 in. long. Had it been of Belpaire shape, I should have specified 13-gauge (3/32 in.) on account of the flat sides and top; bear that in mind if you should be using these instructions for building a similar type of locomotive with a Belpaire boiler. Bend this to the shape shown in the cross-section; this can be done around the barrel, if the sheet copper is annealed first. Put the barrel and wrapper end to end, and measure along the whole distance where they touch. Cut a strip of 16-gauge sheet copper, ⅝ in. wide (or ½ in. if you like) to this length, bend it to a curve that will fit inside the barrel, insert to half of its width, and fix it with a few 1/16-in. or 3/32-in. copper rivets; no fancy heads needed. Put the wrapper over the projecting half, and rivet that in similar fashion; you then have the equivalent of a shell which has been made from sheet-metal, like the 2½-in. gauge version.

The throatplate is next made and fitted, exactly as described for the 2½-in. boiler, the side flanges being riveted to the wrapper, and the front butting up tightly against the end of the barrel; see longitudinal section. The joints can then be brazed, or bronze-



Firebox doorplate

welded, the former operation being done exactly as described for the smaller one, less the barrel seam, and plus the following. First do one side of the throatplate joint, then go along between barrel and throatplate, as before; next, start at the bottom of the other side of the throatplate, and when you reach the barrel again, lay the boiler on its side as quickly as you can, and carry on right around the joint between the barrel and wrapper, turning the boiler shell over, to do the second half. When you arrive at the throatplate again, give it an extra warm-up, and be sure that the brazing material runs well in at the junction point. Warning—this is a job where there must be no "going back." The brazing material should flow well into the "crack" between barrel and wrapper, all the way around, so that it sweats through to the jointing strip. Inexperienced coppersmiths can run some coarse-grade silver-solder in first, if they so desire, applying the



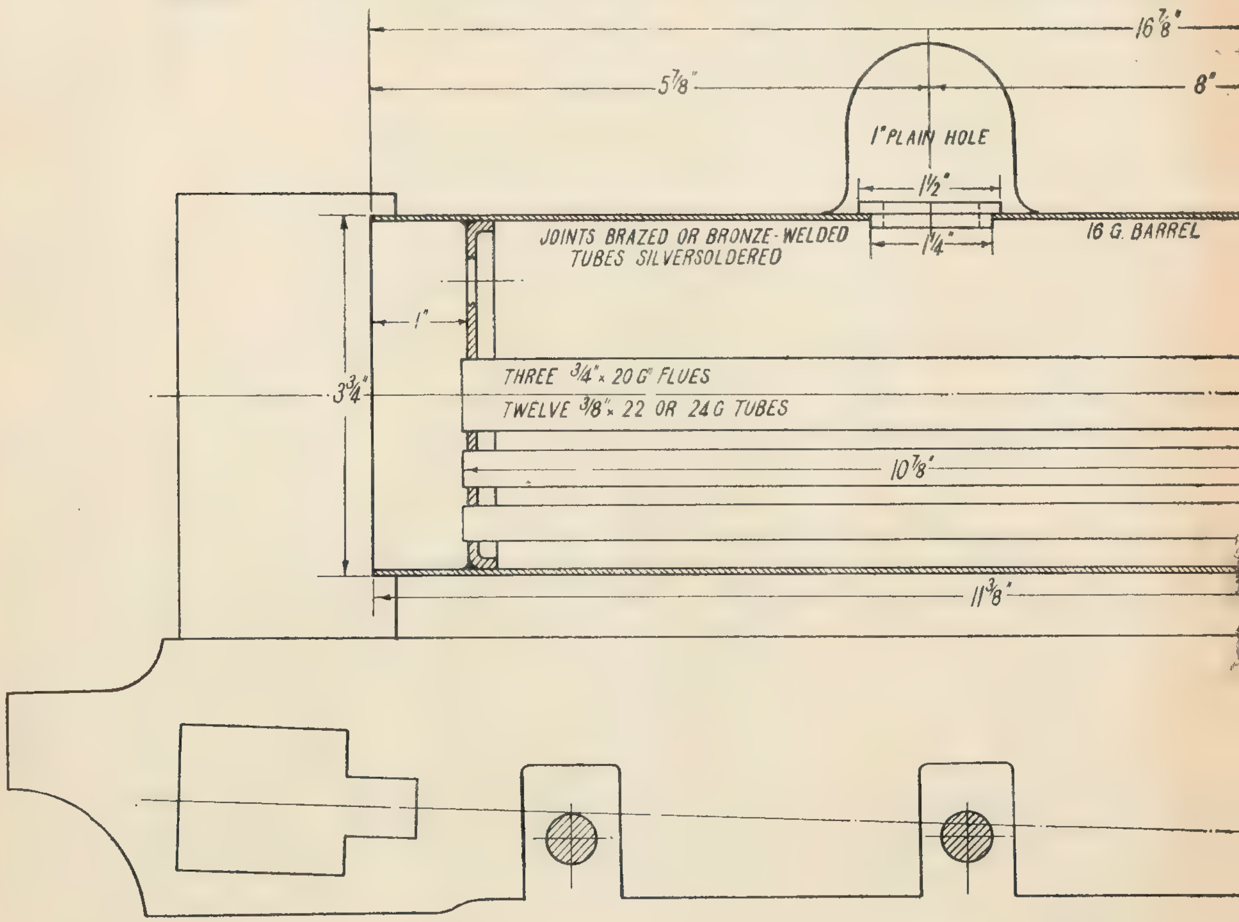
Backhead

brazing strip directly afterwards, but on no account should the whole of the joint be silver-soldered first, and brazing strip applied as a second operation. If expense doesn't matter, a good coarse-grade silver-solder, such as Johnson-Matthey's B6, can be used instead of brazing strip, and will be perfectly satisfactory. Don't forget that the joints should be well cleaned before riveting the parts together; and it is an advantage if a coating of wet flux is applied at the same time, as this helps the brazing material to "sweat" through.

Bronze Welding

The "technique" required with an oxy-coal-gas blowpipe is very little different from the above; very little coke packing is needed, ordinary easy-running brazing-strip can be used, and as it runs like water under the more powerful flame, it sweats readily through all the joints, and a sound job is easily made. I use an oxy-acetylene blowpipe, but my method differs slightly from that recommended in the books on the subject, as I find, in small locomotive-boiler work, a better result is obtained by using a larger tip than recommended for a given thickness of copper, with less gas pressure, so that the flame is a little diffused. Copper, as we all know, is a daddy at dispersing all the heat that is applied to it; and the extra size of flame, kind of overlaps the actual spot where the molten metal is being applied, thus preventing a lot of "therms" scooting off from the scene of operation, where their presence is very desirable.

For the job in hand, I should well cover the joints with wet Sifbronze flux, and stand up the shell in the pan of coke, without any piled around it. The shell would have a preliminary warming with the blowpipe, gently waving the flame over it until the flux had well dried out. I should then apply the flame to the bottom corner, and as soon as it



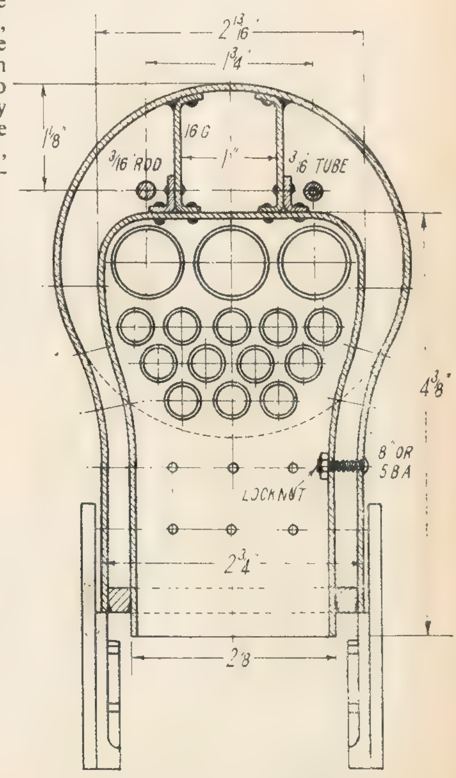
Longitudinal section of boi

became red (a matter of seconds only) the Sifbronze rod would be applied in the flame, and a spot melted off it into the joint. The flame would then be moved slowly along, and the process repeated, each spot of Sifbronze overlapping the previous one, so that the joint has a rippled appearance. With the larger flame mentioned above, the job is practically non-stop. On arriving at the place where the barrel and throatplate meet, I should carry straight on, right around the circumferential seam (straight on around the corner, says Pat) filling up the crack with drops of Sifbronze, then right down to the other corner of the throatplate. The little bit under the barrel, where it joins the throatplate, would finally be treated to a nice fillet, all the way along. The joint thus made, wouldn't come unstuck, nor sprout Welsh vegetables, in a thousand years.

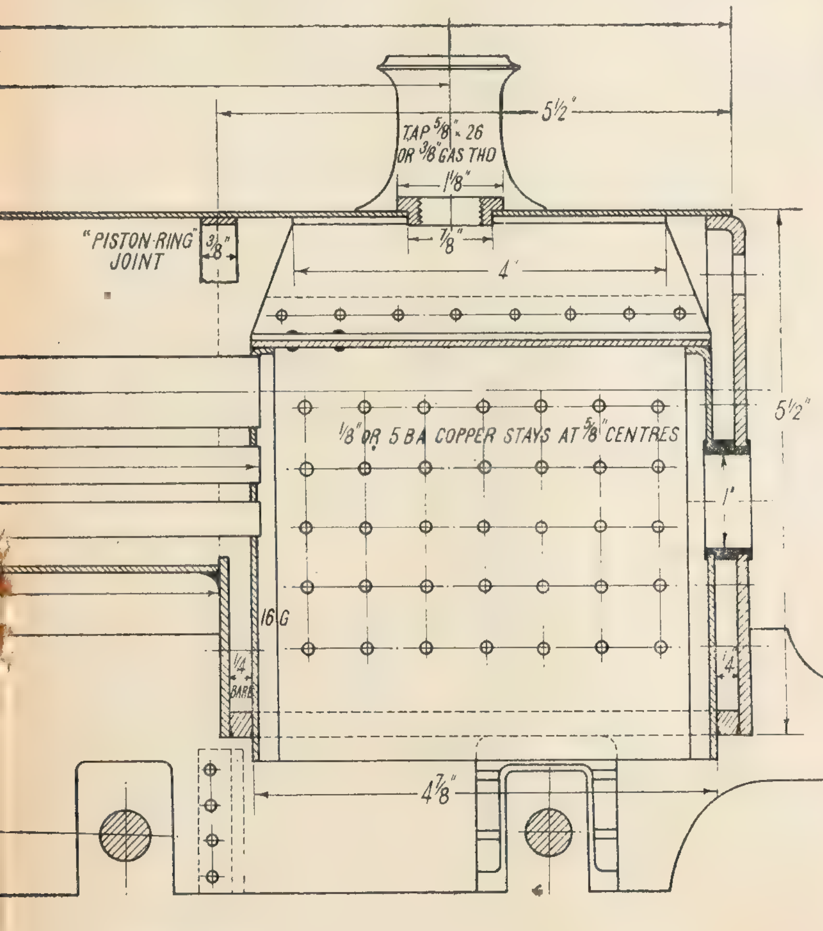
Whichever way the job is done, let it cool slowly to black, in the tray, before quenching out in the pickle bath; then wash off and clean up, and, if properly done, you'll see the brazing material showing all around the joint strip inside the barrel.

Firebox and Tube Assembly

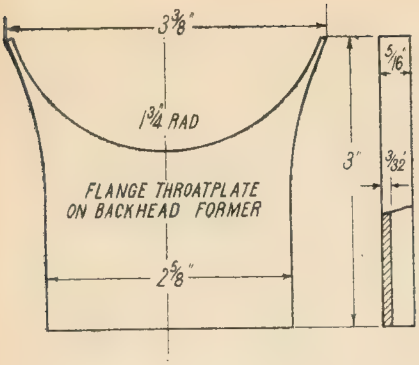
A drawing of the firebox former plate is shown, complete with tube-locating holes, and this is used in the same way as described for the 2½-in. gauge former, the tube and door plates being made from 16-gauge copper. This is plenty thick enough, with the staying shown; the thinner the plates, within reason, the more efficient will the boiler be. The length of the 4⅞ in. wide sheet of 16-gauge copper for the crown and sides of the firebox, is obtained by running a wire around the flange of one of the end plates. The firehole ring should be turned and fitted to the door plate, and the tube holes located, drilled, and reamed, as previously described. The firebox can then be assembled, and the crownstays fitted. These differ slightly from the stays on the 2½-in. firebox; instead of being of Z form, they are made in the shape of a shallow channel, with a piece of angle riveted to the outside. This angle is bent up from 16-gauge copper, in the bench vice, to ¼ in. × ⅜ in. section, and attached by 3/32-in. copper rivets as shown. The whole bag of tricks can then be brazed, or treated with coarse-grade silver-solder, in the same way as the smaller one, taking the same strict caution as before, to avoid making one big ragged hole in place of the tube holes. If Sifbronzing, do the tubeplate first, right around non-stop, and keeping the flame off the tube holes; then do the doorplate, running a fillet around the firehole. A strip of coarse-grade silver-solder can be applied to the crownstay flanges, and *carefully* (very important that) sweated through by judicious application of the blowpipe, but under no circumstances must it be allowed to bubble. After it has sweated in, some Sifbronze can be applied as a finishing-touch, at each side of each flange, and along the top of the joint between channel and angle. Pickle, wash off, and clean up as before.



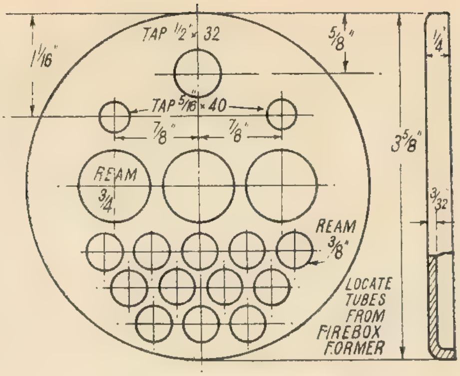
Cross section of firebox



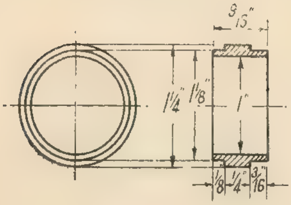
ler for the 3½-in. gauge engine



Throatplate



Smokebox tubeplate



Firehole ring

The smokebox tubeplate can then be flanged up from a circle of 13-gauge sheet copper approximately $4\frac{1}{4}$ in. diameter, over a former $3\frac{1}{2}$ in. diameter, which allows for turning the flange to fit the barrel. The tube holes are set out and drilled by aid of the firebox former, as previously described, and opened out and reamed as shown. Experienced coppersmiths can then insert the tubes, put on the smokebox tubeplate as support and spacer, and silver-solder the lot at one go; smear wet flux around as the tubes are inserted, then up-end the assembly in the coke pan, drop some bits of best-grade silver-solder, or Easyflo, all among the tubes, and carefully heat up the whole lot to medium red, when the silver-solder should melt and flow freely around the whole bunch. Not-so-experienced workers should, first of all, insert the two inner rows only, proceeding as given for the $2\frac{1}{2}$-in. gauge job; then, if O.K. after pickling and cleaning up, the bottom row of small tubes, and the superheater flues, can be inserted, and the process ditto-repeatoed. You won't crack the silver-solder around the first lot, when doing the second, as it will melt and re-set when the second batch cools. Anneal all the outer ends as previously described.

Firebox and tube assembly, and the smokebox tubeplate, are then inserted in the boiler shell, and fixed as described two weeks ago. Use a piece of $\frac{1}{4}$ in. square copper rod for the front section of the foundation ring, filing it clean, and slightly bevelling it on what will be the bottom corners; fix with 3/32-in. rivets. Same size rivets are used for fixing the crownstay flanges to the top of the wrapper. Drive in the smokebox tubeplate, expand the tube ends by aid of a taper drift, as on the smaller job, then perform the blowlamp act, using either brazing strip, or coarse-grade silver-solder for the barrel joint, and best-grade, or Easyflo, for the tubes. The coarse-grade can also be used for the crownstay flanges.

Final Assembly

The final stage of the proceedings is carried out as described last week. The shape and size of the backhead former is shown by the dotted lines in the drawing of the backhead itself, which is flanged up from $\frac{1}{8}$-in. copper, to dimensions shown. Don't forget to cut the hole for the firehole flange undersize at first, then offer up the backhead in place, to make certain of the correct position of the finished hole. Then insert backhead, beat down the lip of the firehole ring, and squeeze the sides of wrapper into close contact with the backhead flange, securing with stubs of 3/32-in. screwed copper wire. The remaining sections of the foundation ring are made from $\frac{1}{4}$-in. square rod, cleaned and bevelled as mentioned above, and fixed with 3/32-in. copper rivets. The bushes for dome and safety-valve, can be turned from thick copper tube, or may be castings in copper, or the weldable metal used for plumbing fittings that have to be bronze-welded; don't use brass.

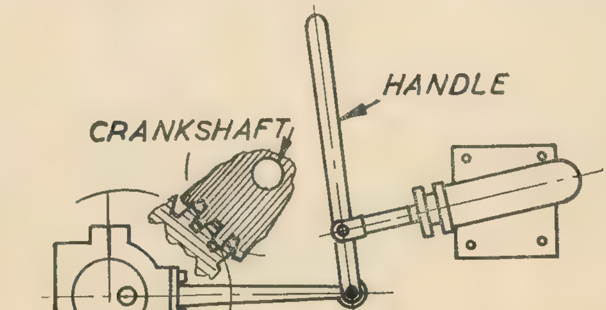
The final brazing job needs plenty of heat, and as the process was detailed last week, repetition is unnecessary; but I'll add a PS. to it. If you can get a " mate " to hold another blowlamp at one side of the foundation ring, while you play on the other, the brazing material, caught between two fires, will run like water, and make a perfect seal. See next instalment for notes on oxy-acetylene operation.

REBUILDING A STEAM TRACTOR

(*Continued from page* 409)

red oxide, then the finishing coat, which is a lovely mid green, then the lining, which is in red and yellow. This took by far the longest time. All parts which were originally finished bright were given two coats of aluminium radiator paint, and one coat of clear varnish which makes it look remarkably like bright steel.

Since then, many happy hours have been spent driving her; governors are to be fitted soon, so that I can use her to saw wood. One or two jobs still remain to be done, the pipes missing from the cylinder drain cocks will be replaced; also, a brass cap for the chimney. And then we shall be all ready for one or two 1955 rallies. I hope to have a steam-up in the near future for the benefit of my fellow-members of the Billericay S.M.E. I would like to end by tendering my thanks to all those who helped me in this venture, including those who supplied the very welcome cups of tea !



Sketch showing arrangement of pump for the hydraulic test pump gear being driven from the crankshaft

A $1\frac{1}{4}$-in. scale Burrell

By A. H. Riggall

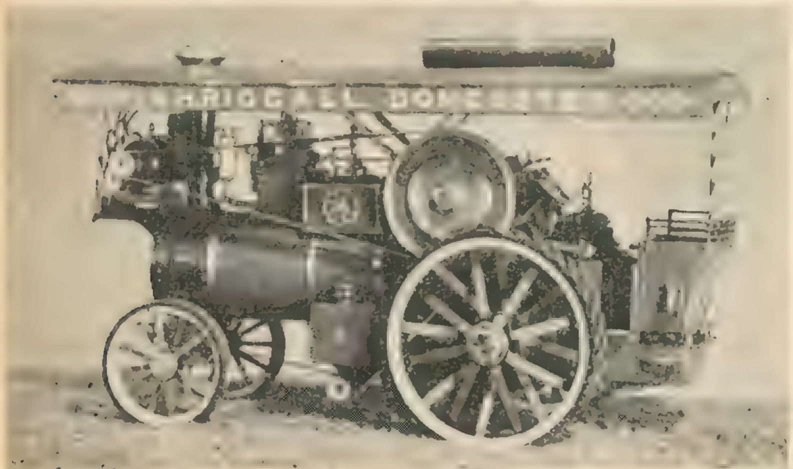
THE photographs show a $1\frac{1}{4}$-in. scale Burrell showman's engine that I have built out of scrap. The only parts purchased are the pressure gauge, pump casting and Stuart lubricator.

The boiler is built up from 14-gauge copper cut from an old Army tank, it has six $\frac{1}{2}$-in. tubes, and fire-bars and ashpan are combined as per " L.B.S.C." instructions for locomotives.

The cylinder is built up from brass, and is $\frac{3}{4}$ in. diameter × 1 in. stroke and fitted with trunk guides, and locomotive-type safety-valves. The governors are dummy, as they are too small to work. The crankshaft is turned out of the solid, from a length of 1-in. shafting. The gears are cut from 1 in. and 3 in. shafting, as I have a power hacksaw, and the teeth were milled in the lathe. The tender is made from the same copper as the boiler, and has a hand-pump under the footplates. The belly-tank is made from the lid of an old gas copper, and is connected to the tender tank. The working pressure is 60 lb., and the safety-valves are set to blow at 70 lb.

The flywheel was turned from a slab of 5-in. shafting, and has the usual brass ring and cap. The chimney and base came out of $1\frac{1}{2}$-in. shafting, and are tapered inside as well as outside.

The back wheels are $7\frac{1}{4}$ in. diameter; the rims are turned from an old brass sleeve bearing (Army surplus). The hub is built up from brass plate and tube turned to size. Each wheel has 16 spokes from $\frac{1}{16}$-in. steel plate. There is a working hand-brake on one side, and a 6-ft. steel rope on the other side.

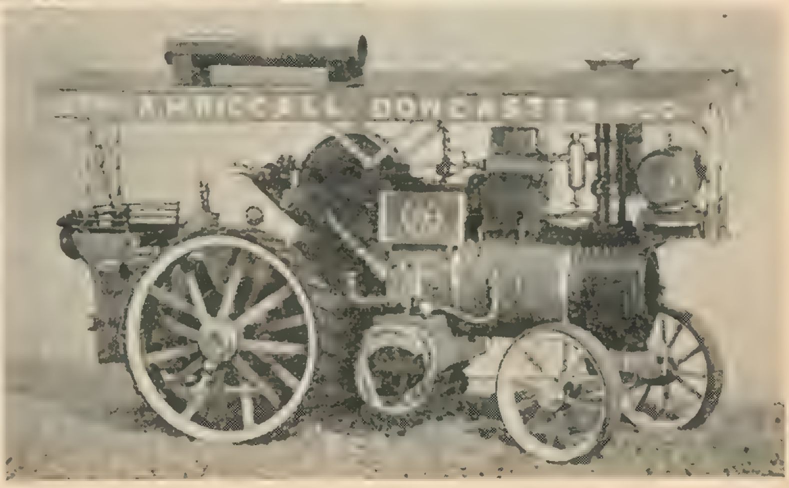


The front wheel rims are turned from $4\frac{1}{2}$-in. shafting. The hubs are of brass, and spokes are of $\frac{1}{16}$-in. steel plate; there are 12 spokes per wheel. The injector will lift $1\frac{1}{4}$ pints of water with a 15-in., $\frac{3}{16}$-in. bore rubber pipe with 50 lb. " on the clock."

The dynamo is built up, the body being of brass and the end plates turned from 2-in. shafting. An old-type Miller cycle dynamo fitted inside, with the engine running at 150 r.p.m. it will light two 4-V., 0.5-A lamps under the canopy. I may add that the engine has pulled me on a four-wheeled truck, also with the wire rope.

The painting I have done myself, the boiler and tender are green, wheel rims yellow, spokes red and hubs black. I have no fancy painting on it, as I have built it to work; and when it gets the paint burnt, I give it another coat. This engine has taken me eight years to build, but as I have bad health, there was not much done at a time; also, I may add that the lathe I have is a $7\frac{1}{2}$-in. Butterfield and the small parts take a bit of making with a 14-in. chuck !

The engine has been under steam about 140 hours, and I have had no trouble at all. The length is 1 ft. 10 in., width over back wheels $9\frac{1}{4}$ in., weight approx. $3\frac{1}{2}$ stone in working order. She was copied from one lying in a scrap yard until 1950, and then I had to rely on photographs in back numbers of THE MODEL ENGINEER to finish it. She is named *Dora*.



A Parting Tool for the Back-toolpost

By "Duplex"

READERS may remember that, some years ago, we described in this journal the making of a two-tool toolpost for mounting at the rear of the cross-slide, and it seems that quite a large number of these accessories has been built from castings supplied by Mr. Haselgrove.

In the original design, the parting tool specified was made from an Eclipse cutter-bit of ¼-in. square section, but a tool of this size lacks strength in the vertical direction when ground for parting-off work of large diameter; moreover, some workers have found difficulty in grinding a narrow tool with the appropriate clearance and relief angles.

With this in mind, we have made and used a new turret that can be mounted on the original base and secured with the existing clamping-screw. To overcome any difficulty in grinding the tool, the Eclipse hollow-ground parting tool blade is used.

These blades are only $\frac{1}{16}$ in. in breadth and, as they are 4½ in. in length, they can be divided to make two tools suitable for use in the turret. The front clearance angle is already ground at either end, so that, by grinding the two remaining ends, four cutting edges are made available.

To give free-cutting, the tool is set obliquely in the turret to form a top rake of 5 deg. and, with an overhang of 1 in., material up to 2 in. in diameter can be parted off. Moreover, the opposite face of the turret is left blank, and this can be machined to carry the tool horizontally, and without top rake, for parting brass or material of a diameter larger than 2 in.

The turret is fitted with an adjustable guide-plate, which ensures that the tool is always positioned exactly at right-angles to the lathe axis.

The body A of the prototype was made from a short length of 1¼-in. square mild-steel, but an iron casting is equally suitable.

After the four vertical sides have been filed or machined flat and square, the part is centred in the four-jaw chuck for turning the register and facing the abutment surface. This register is machined to an accurate fit in the existing base of the toolpost.

The axial bore to accommodate the clamping-bolt should be drilled over-size or finished with a small boring tool, in order to avoid binding on assembly, for the register, alone, serves to locate the turret on its base.

The body was next turned end for end and again centred from the bore for machining the recess, into which the handled clamping-screw fits. In this way, the original clamping-bolt can be retained and used for securing the new and longer turret.

Although the oblique slot for housing the parting tool can be machined in the lathe, this work is, perhaps, more easily carried out in the shaping machine. It will be noted that the floor of this slot is machined on the slope; this is to ensure that the taper-sided tool stands exactly upright when finally mounted in the turret. The particular tool fitted measures 0.059 in. across the top face and 0.043 in. across the lower, giving a difference of 16 thou. in. in a length of ½ in., and corresponding to an included angle of almost exactly 2 deg.

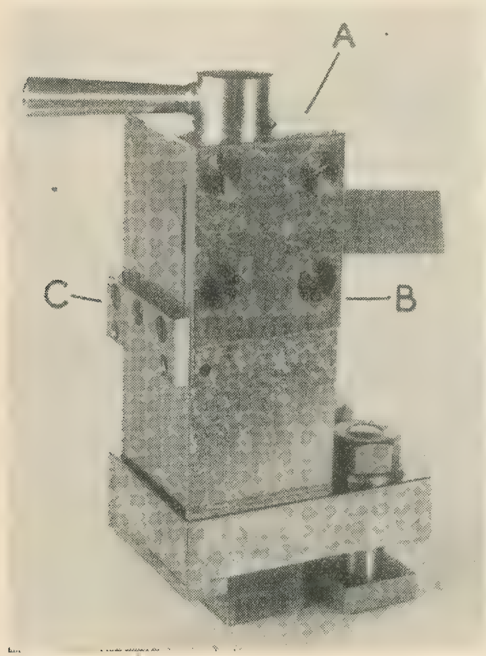
An angle of 1 deg. was, therefore, marked-out on the face of the turret and it was mounted in the shaping machine with this line parallel with the upper face of the vice jaws. The vice was also set over to an angle of 5 deg. for machining the housing, so as to allow for the top rake required on the parting tool.

However, those who wish to do so can machine the slot to an even depth, and put in a packing-strip, to align the tool vertically when finally mounted in place.

After the slot had been cut to width, so as to fit the tool closely, the clamp-plate B was secured to the body with a pair of toolmaker's clamps. With the parts in this position, the holes for the four 2 B.A. securing-screws were drilled and tapped, and their mouths were afterwards countersunk to accommodate the screw heads. There is no objection to fitting countersunk screws here, as they merely clamp the parts together and do not have to provide exact location of the clamp-plate.

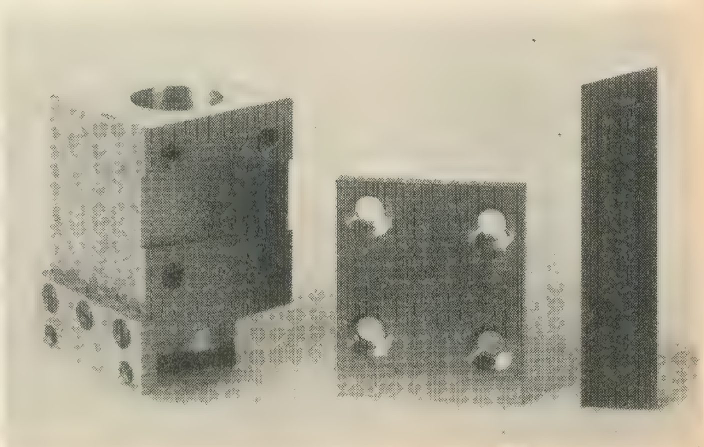
Aligning the Parting Tool

The guide-plate C is secured to the rear face of the turret with three 6 B.A., cheese-head screws and, as shown in the drawing, two additional holes are drilled towards the lower edge of the plate; these holes are to allow a screwdriver to enter and turn the adjusting-screws



Left: Fig. 1. The new turret mounted on the original base of the toolpost A—the body; B—the tool clamp-plate; C—the guide-plate

Below: Fig. 2. The turret parts and the divided parting-tool blade



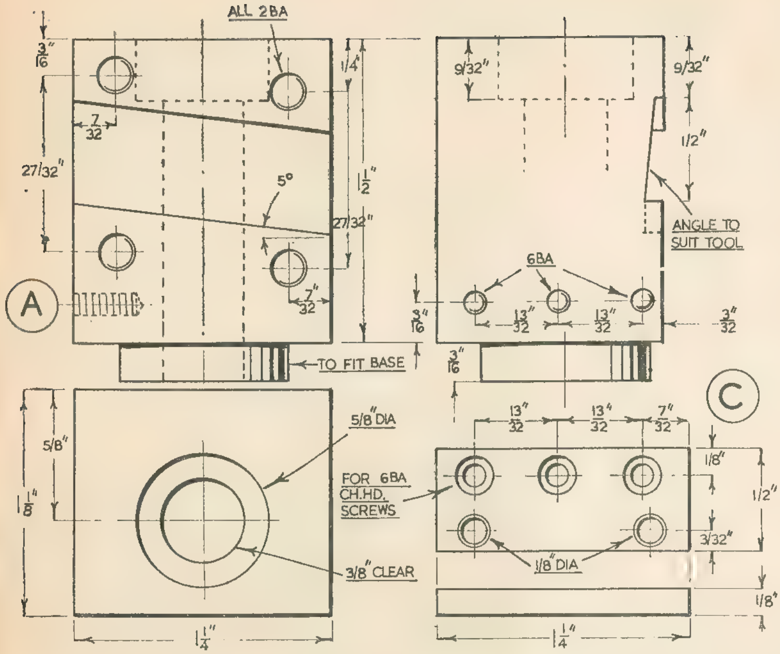


Fig. 3. The turret body and guide-plate

fitted to the base of the attachment. The next step is to mount the assembled toolpost on the lathe cross-slide, where it is aligned by the locating strip attached to the underside of the base. The easiest way, perhaps, of aligning the parting tool at right-angles to the lathe axis is to face a short length of material, gripped in the chuck, and then to turn the turret until the tool makes exact contact with the machined surface. If the turret is now securely clamped in place, the attachment can be removed from the lathe and the holes for the adjusting-screws in the base spotted through the holes previously drilled in the guide-plate.

After the two 2 B.A. adjusting-screws have been fitted, the base is drilled on either side face for the 6 B.A. grub-screws which serve to lock the adjusting-screws.

The attachment is again mounted on the cross-slide and the parting tool aligned as before. By turning the adjusting-screws until they bear on the guide-plate, and then locking them, the turret can at any time be removed and replaced with the parting tool remaining always correctly aligned.

As the parting tool projects for some distance, it will usually be found more convenient to turn it aside when other work is undertaken. If the body has been correctly machined, the turret can be lifted and then turned through a right-angle to allow the parting tool to point towards the tailstock.

So far the Eclipse blade has been kept at its full length of $4\frac{1}{2}$ in., but it is now divided to form two tools. This is easily done by mounting a narrow cut-off wheel on the grinding head and then feeding the tool slowly forward on the grinding rest with a firmly controlled motion. Although these cut-off wheels appear to be rather fragile, they are really quite strong if not submitted to side pressure; nevertheless, it may be thought advisable to keep the head turned aside, in case of an accident arising from clumsy manipulation of the tool. The wheel we use for this work, and for other light jobs involving cutting high-speed steel, was supplied by the Universal Grinding Wheel Co. of Stafford, and is 6 in. in diameter and $\frac{1}{16}$ in. in thickness. The shellac-bonded wheel is of M grade and has a grit size of 60. For the sake of safety, it is important to mount and use wheels of this type strictly in accordance with the manufacturer's instructions.

The Parting Tool in Use

As the tool is mounted at an angle and points slightly downwards, it can be readily adjusted to centre height by altering the distance it projects from the turret; this setting is easily made by reference to the tailstock centre.

As the broad, lower surface of the tool has parallel sides, no relief is given behind the cutting edge; it is, therefore, important to reduce friction by maintaining a continuous supply of cutting oil to the tool. When the tool becomes blunted, only its end face must be ground. For this purpose, the tool should be clamped vertically in a small vice and then fed against the side face of the grinding wheel, after the grinding rest has been set to an angle of some 15 deg. so as to form the necessary front clearance. When parting off work of large diameter, it is advisable to keep the tailstock engaged to support the work until the tool has reached a considerable depth. Should the tool tend to grab, the cross-slide locking-screws should be partially tightened so as to make the feed somewhat stiff.

Chatter can usually be avoided by reducing the lathe speed.

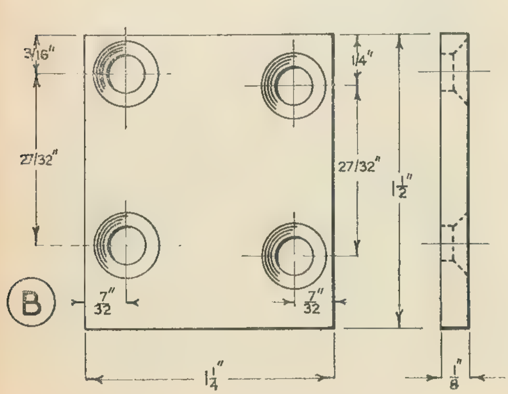


Fig. 4. The plate for clamping the tool

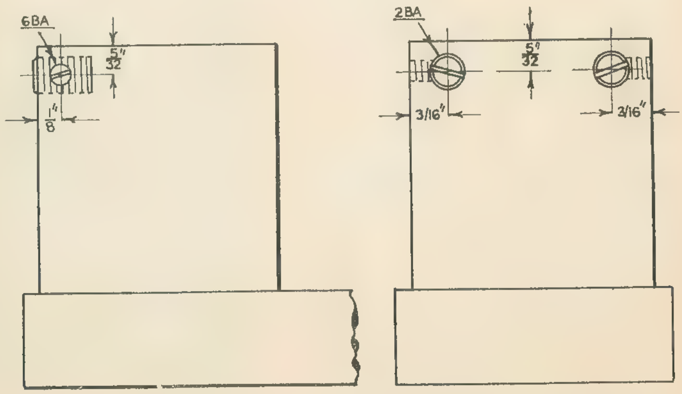


Fig. 5. Showing the position of the adjusting-screws fitted to the base of the toolpost

METHODS WITH MINIATURES

By "Scotia"

ALTHOUGH I have explained from time to time many of the fundamental principles involved when using hand-turning tools, perhaps it may be of interest to review some of the methods resorted to in the course of making and completing small oddments in brass or bronze. The little trinket box shown in the photograph is rather attractive, and in common with the other pieces shown, is restricted in size to $1\frac{1}{2}$ in. in diameter, bearing in mind the scarcity of material. Thus it is possible to use up to good purpose short ends of metal one may have in the scrap-box.

As shown in Fig. 1, a hole is bored in the material just big enough to allow an inside grip by the self-centring chuck, and this position offers the opportunity of finishing the exterior of the work in its entirety, affording the worker a freedom of movement usually absent in the more orthodox methods of chucking. This is especially so when hand-tools are brought into use.

To complete the work, it will be noted from Fig. 2 that the simple split bush has a groove turned on the inside diameter, which accommodates the bead on the body and cover very securely, and has the added advantage that it does not mark the workpiece.

The machining required here is done with a boring tool in the saddle, the hole being enlarged and deepened to requirements, care being taken to leave about $\frac{3}{16}$ in. thickness at the bottom for the purpose of fitting the feet to the casket. It is advisable to see that a small radius is made in the inside corner, for appearance and ease o cleaning. The boring tool requires to have a slight radius ground on it for this purpose.

In many pieces of so-called craftsmanship I have examined, square corners seem to be the order of the day. True, some of them are incorporated with the general scheme of the piece, and can hardly be avoided, but the incidence of square corners on all ornamental turning should be kept to a minimum. A suitable surface finish for the inside of the box is that made by smooth, but new emery cloth, and it is quite in order to leave it with this obvious finish, as it gives character to the work. With the lathe at top speed, and taking great care, a piece of emery is held to the work and gradually run off.

Photograph, showing comparative sizes!

The same split bush will be suitable for use when turning the inside of the lid, and according to one's desire, the interior can be generally lightened, leaving a dome-like surface, or one can endeavour to create a contour much similar to that of the exterior, with a view towards making it as light as possible.

Do not overdo this, however, as it is very easy to ruin the work, and if the lid seems a little heavy when finished, remember that this too gives character to the piece.

A round-nose tool in the saddle is all that is required for this part of the work, smoothing off finally with emery cloth.

A Simple Method of Locating Feet

Here is an easy method of obtaining the three positions for the feet: The body of the casket is held lightly by an inside grip in the 3-jaw chuck. A solid or tubular piece of metal is held upright with one end resting on the sheers—the lathe spindle is turned by hand until the chuck jaw is resting on the other end.

By this simple method of using a piece of bar in the manner of a detent, three accurate positions are indexed, making it possible to mark correctly the respective positions required. Drill and tap 6 B.A., taking care not to break through—about an eighth deep is sufficient.

Making the feet are simple little exercises in hand-turning, and for simplicity they are drilled and tapped 6 B.A. and studded. This method is far easier and stronger than turning down and screwing with a die, as breakages of the material can be annoying.

Before shaping up the feet, it is wise to use the parting tool to just a shade

Note how the light accentuates all grooving work—the radii on the bottom of the pieces are really very slight

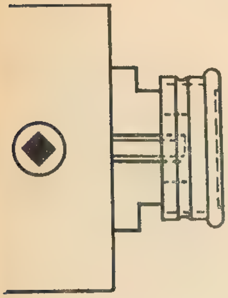


Fig. 1. Exterior completed at this setting

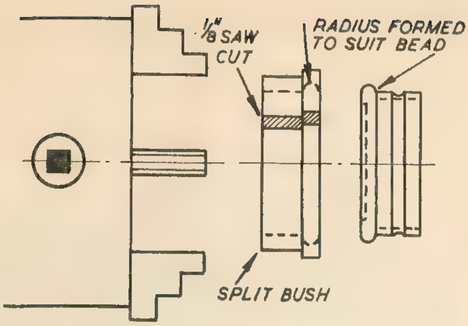


Fig. 2. Exploded view, showing grip for finishing

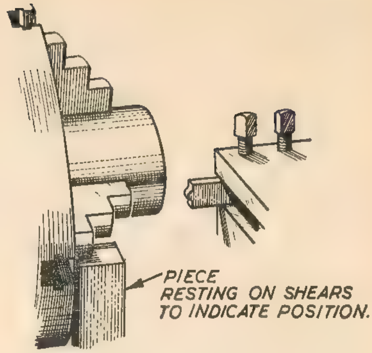


Fig. 3. The lathe being stationary, the saddle is worked transversely to obtain grooves—the tool being clamped on its side

below the small diameter, in order to obtain a uniformity of shape and length in the latter.

When the little feet are parted off, file the little pip flush—screw the parts into the body and gently rub to and fro on a piece of emery. In order to enhance the general appearance, the work should be highly finished throughout, with the exception of the interior, as already mentioned. When this article is made larger than the size shown here, it is possible to obtain a certain squatness which is at once so attractive that one would not have it otherwise. This is largely due to keeping the main body of the casket shallow in depth. Owing to the small size of the one shown here, it is not possible to achieve this effect, but perhaps readers will perceive what is meant.

Now let us study the little grooved ash-tray shown in the photograph. All the machining required is done in the lathe. The position for the grooves is found by the same method as that described for the feet of the trinket-box.

With the lathe stationery, a suitably ground tool is clamped on its side in the saddle. The cross-slide handle is worked to and fro, feeding-in being very slight, by increments of about 5-thou. each stroke, till a suitable depth of groove is made; nothing could be simpler. Grooving should always be carried out last.

The Value of a Good Finish

It will be noticed that the little ash-trays are not quite flat on the bottom, a slight curvature being present. Articles such as these are much improved when dead flatness is avoided—a nicely finished curved surface will show up well even in a poor light, conveying at once the impression of excellent finish and good workmanship.

However, it is hardly possible to attain this object, unless one is prepared to

(*Continued on page* 430)

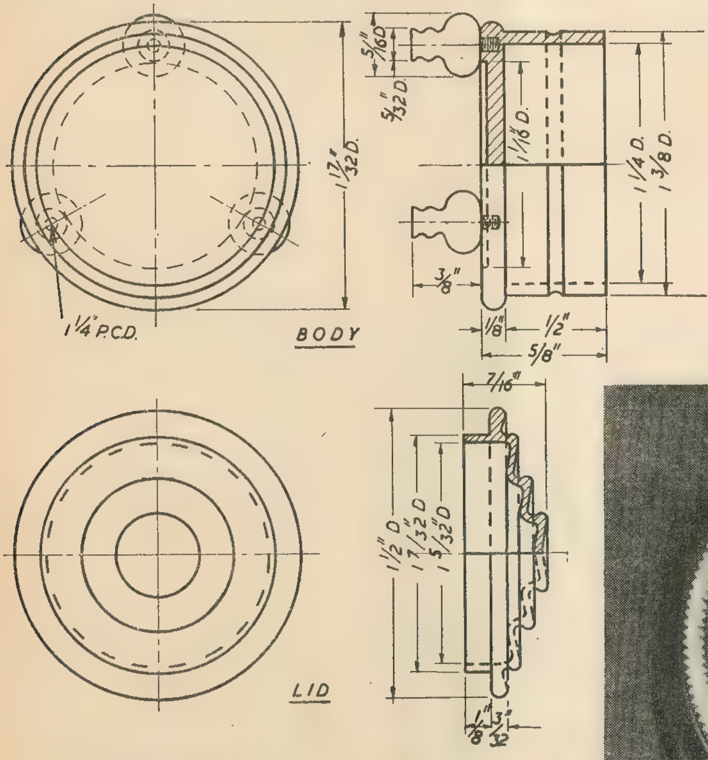
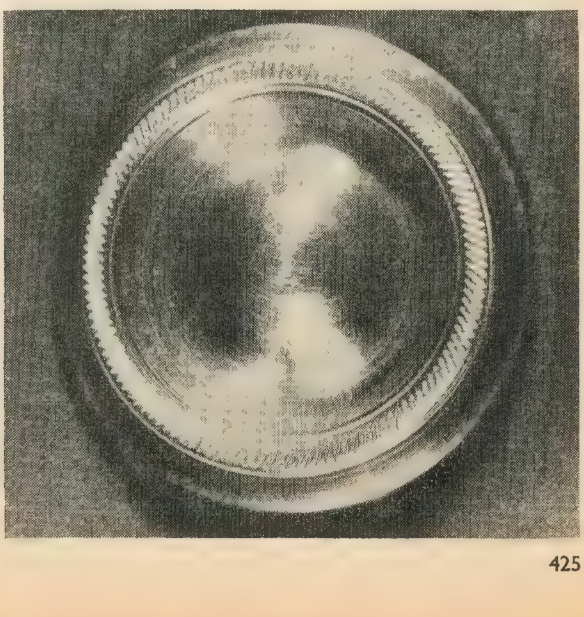


Fig. 4. Dimensions of the small trinket box



Right: A close-up photograph, showing effect of face knurling

An Automatic Cross-feed

A SIMPLE ATTACHMENT SUITABLE FOR THE M.L.7 AND SIMILAR LATHES

By I. Wilson

General view of the attachment

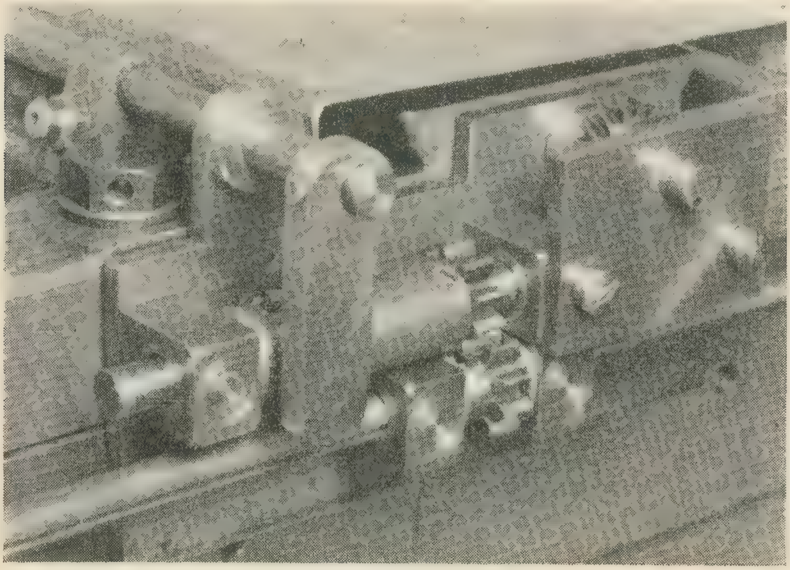
ABOUT two years ago, I designed and constructed an automatic feed for the cross-slide of my M.L.7 lathe. Since then the mechanism has been in daily use, and has given complete satisfaction, so as there must be other owners of this lathe who, like myself, consider an automatic crossfeed an advantage, I am giving detailed drawings and instructions for its construction. It is simple to construct, taking but a few hours, and once installed, it is unobtrusive and does not interfere in any way with any other function of the lathe. The feed is engaged and disengaged by a lever at the front of the saddle and the feed in t.p.i. is the same as that set up for saddle traverse.

The mechanism is mounted on a small plate at the back of the saddle (see Fig. 1) and drives an extension to the cross-slide screw. A long shaft at the back of the lathe bed takes the drive from the lathe leadscrew by chain and sprocket (see Fig. 2). This main shaft is mounted on a bearing and bracket, bolted to the lathe bed at the tailstock end, and is supported by two bearings attached to the mounting plate. Between these two bearings is located a spur gear, the drive being imparted to the gear by a key from a keyway on the mainshaft.

An intermediate shaft situated above the main shaft on the mounting plate has a second and similar spur gear attached to it. Depressing the lever at the front of the lathe saddle, slides this gear into mesh with the one on the main shaft. The drive is then taken from the intermediate shaft to the extended feedscrew of the cross-slide by a pair of skew-gears, each of which is located endwise by the bearings in which their respective shafts run, the motion being transmitted from shafts to gears by keys.

The skew-gears, of $\frac{5}{8}$ in. diameter, give a 2 to 1 reduction, and the spur gears of $\frac{1}{2}$ in. p.c.d. have 10 teeth, 20 d.p. Thus the cross-slide screw turns at half the speed of the main shaft, but the main shaft turns at two-and-a-half times the speed of the leadscrew, therefore the cross-slide screw turns one-and-a-quarter revs. for each rev. of the leadscrew. As the leadscrew is 8 t.p.i. and the cross-slide screw 10 t.p.i. a simple calculation shows that the travel of both the saddle and cross-slide will be the same.

All the shafts are $\frac{1}{4}$ in. diameter steel, and for the main shaft, this is rather slender, but as this shaft turns at twice the speed of the cross-slide screw, the turning force on it is halved.



Close-up view of mechanism mounted at rear of saddle

Mounting Plate

This is a piece of $\frac{1}{8}$ in. thick mild-steel, cut to the shape shown in the drawing, marked out and drilled $\frac{1}{4}$ in. for the bearing blocks. The plate is secured to the back of the lathe saddle by two countersunk screws, 2 B.A., and details of how to position it will be given later. A bronze bush, through which the cross-slide screw extension passes, is made a press fit and positioned as shown on the drawing. The other bush is best left until the plate is affixed when a pointed rod passed through the lever bearings will mark the correct position.

Bearing Blocks

These are pieces of mild-steel bar, $\frac{1}{2}$ in. by $\frac{3}{8}$ in., with a spigot turned a close fit for the holes drilled in the mounting plate. Five blocks are required, two of which will later have holes tapped 4 B.A. in the ends opposite the spigots to secure the thrust plate On one bearing block, a $\frac{1}{8}$ in. diameter hole is drilled through the centre of the spigot and into the bronze bush bore. This is to take the $\frac{1}{8}$ in. diameter ball and spring which registers with the grooves in the intermediate shaft, and holds this shaft in the engaged or dis-

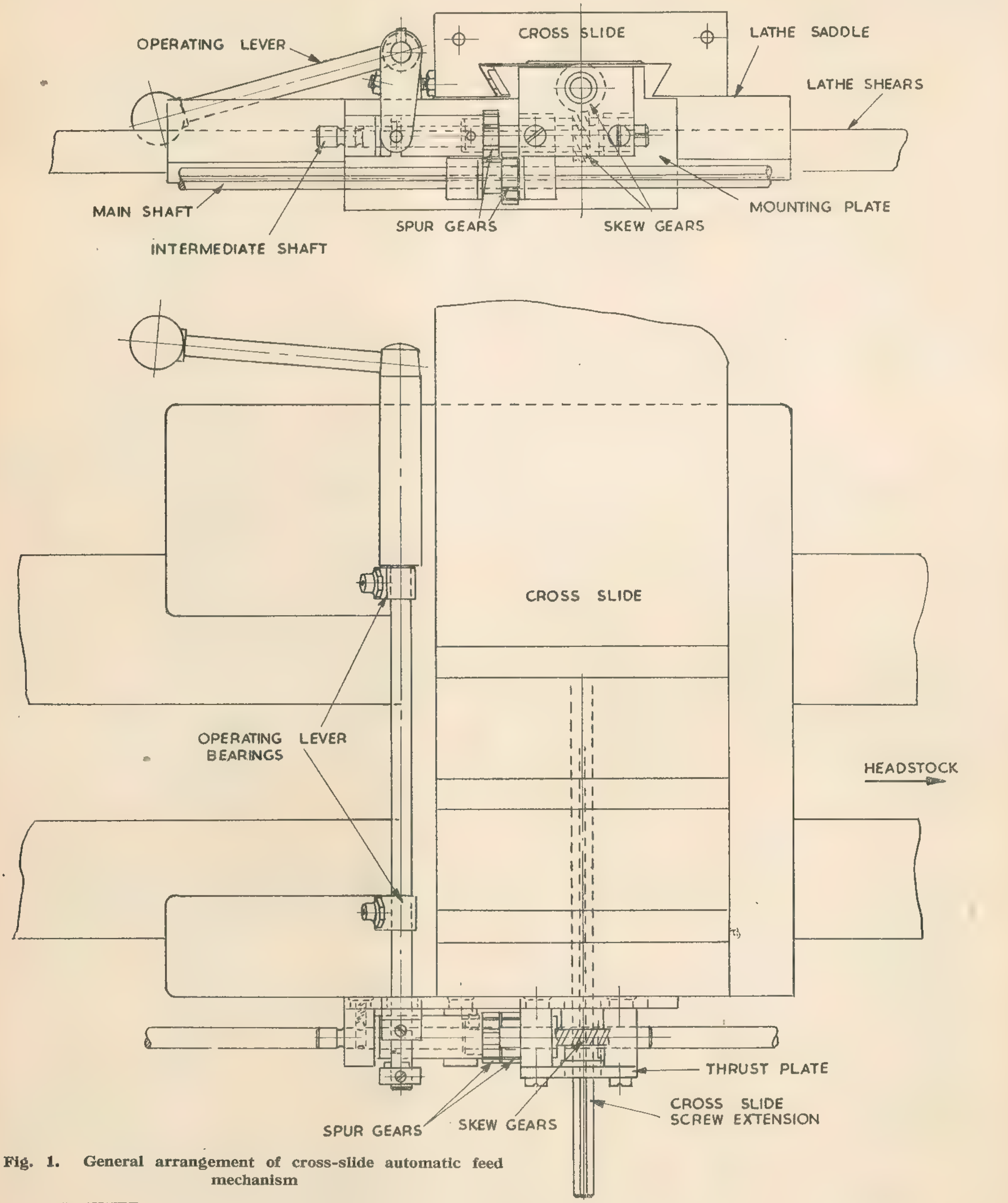


Fig. 1. General arrangement of cross-slide automatic feed mechanism

engaged position. The outer end of the spring is pressed against the lathe saddle when the plate is mounted in position.

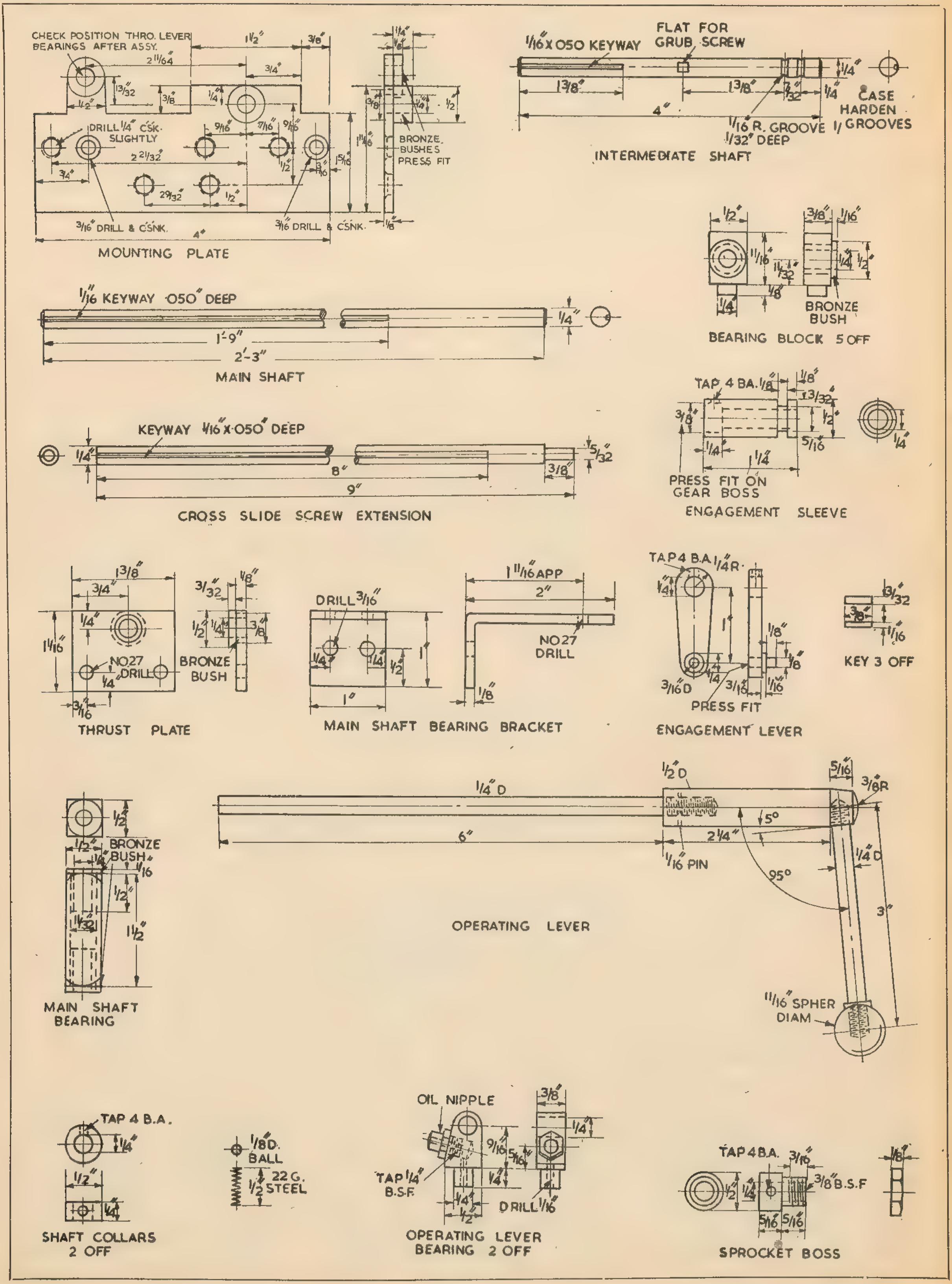
As it is essential that the bores of these bearings should be in line, the blocks had best be mounted on a small angle-plate on the faceplate, and bored $\frac{3}{8}$ in. for the bronze bushes. When the blocks are completed, they are secured to the mounting plate by lightly riveting over the spigot. Reference to Fig. 1 will show in which direction the bronze bush flanges should face.

Operating Lever Bearings

These have spigots made a light drive fit for the oilway holes on the top surface of the lathe saddle. The oil nipples are prised out and the bearings driven in. Substitute oil nipples are mounted on the inclined faces of the bearings, and the oil passes through a drilled passage in the spigot. The rear bearing requires a bit filed out to clear the carriage locking-screw boss.

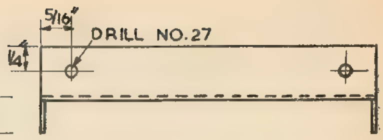
Engagement Sleeve

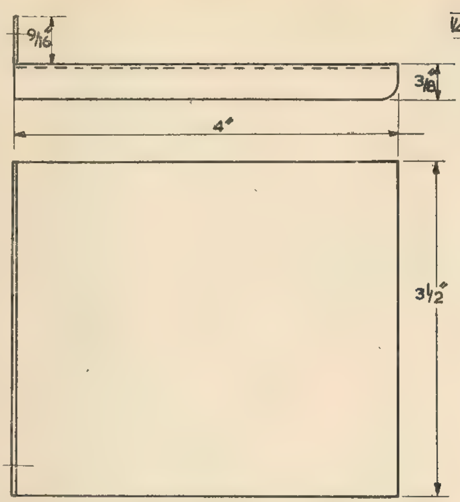
A piece of $\frac{1}{2}$ in. diameter mild-steel, is drilled through $\frac{1}{4}$ in., and bored at one end $\frac{3}{8}$ in. diameter $\frac{1}{4}$ in. deep, a


CHECK POSITION THRO. LEVER BEARINGS AFTER ASSY.
DRILL 1/4" CSK. SLIGHTLY
BRONZE BUSHES PRESS FIT
3/16" DRILL & CSNK.
3/16 DRILL & CSNK.
MOUNTING PLATE
1/16 X 050 KEYWAY
FLAT FOR GRUB SCREW
CASE HARDEN GROOVES
1/16 R. GROOVE 1/32" DEEP
INTERMEDIATE SHAFT
BRONZE BUSH
BEARING BLOCK 5 OFF
1/16 KEYWAY ·050" DEEP
MAIN SHAFT
TAP 4 BA.
PRESS FIT ON GEAR BOSS
ENGAGEMENT SLEEVE
KEYWAY 1/16" X ·050" DEEP
CROSS SLIDE SCREW EXTENSION
NO 27 DRILL
BRONZE BUSH
THRUST PLATE
DRILL 3/16"
1 11/16" APP
NO 27 DRILL
MAIN SHAFT BEARING BRACKET
TAP 4 B.A. 1/4" R.
3/16 D
PRESS FIT
ENGAGEMENT LEVER
KEY 3 OFF
BRONZE BUSH
MAIN SHAFT BEARING
1/4" D
1/2" D
3/8 R
1/16" PIN
OPERATING LEVER
11/16" SPHER DIAM
TAP 4 B.A.
SHAFT COLLARS 2 OFF
1/8 D. BALL
22 G. STEEL
OIL NIPPLE
TAP 1/4" B.S.F.
DRILL 1/16"
OPERATING LEVER BEARING 2 OFF
TAP 4 B.A.
3/8" B.S.F.
SPROCKET BOSS

press fit for the boss on one spur-gear. After pressing in the gear, a 4-B.A. hole is tapped through sleeve and boss, and a grub-screw secures both firmly to the intermediate shaft. The groove at the other end is turned as shown.

The gears were purchased from Bonds, and have $\frac{1}{4}$ in. diameter bores; both skew-gears and one spur-gear require keyways cut in the bores and small keys pressed in. The keyways are cut by gripping the gears in the lathe chuck and applying the small tool illustrated in Fig. 4 which is made by filing a scrap of silver-steel to shape and brazing it into the end of a piece of $\frac{3}{16}$ in. diameter steel. The width of the tool cutting edge should be a bare $\frac{1}{16}$ in. so that the slot cut will be a tight fit for the little key, cut from a scrap of $\frac{1}{16}$-in. steel plate and pressed in. The keyways are cut to a depth of 0.050 in.





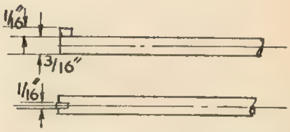


Fig. 4. Tool for cutting keyways in gears

Shafts

All these are made from $\frac{1}{4}$ in. diameter mild-steel. The end of the intermediate shaft, having two grooves, should be case-hardened to avoid unnecessary wear by the steel ball. The cross-slide screw extension should be left about 12 in. long, until the keyway has been cut. The keyway in the main shaft is 21 in. long, and this and the other keyways can be cut in the lathe. For the benefit of those readers who are prepared to try a job like this, and not just sit back and say it is not possible, I will give details of the method I have used successfully on a number of occasions.

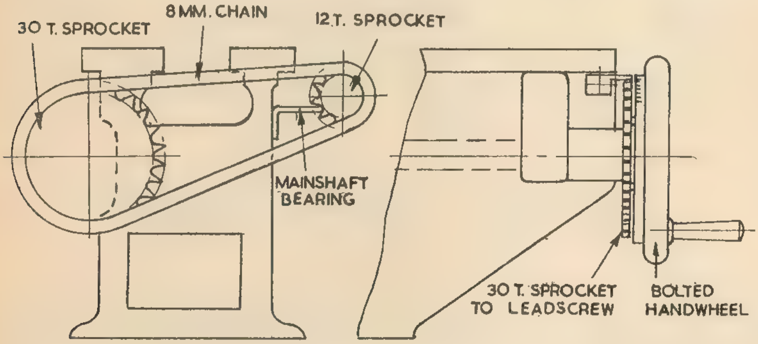


Fig. 2. Tailstock end of lathe, showing chain drive from leadscrew to main shaft

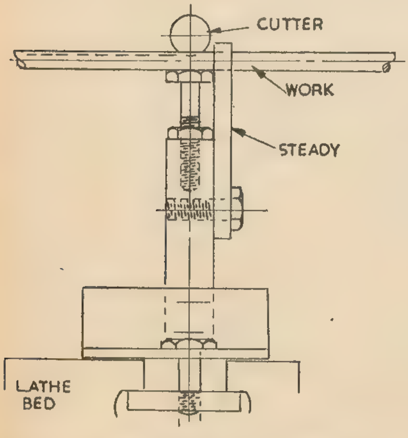


Fig. 3. Diagram showing jack supporting work under cutter

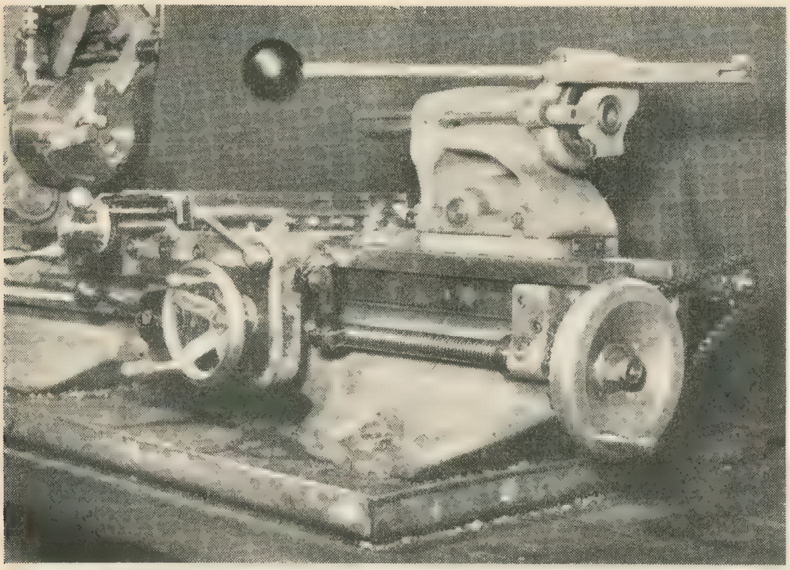
A small Woodruff type cutter, $\frac{1}{16}$ in. thick, is required, and this can easily be made from a piece of silver-steel. These keyways are to be a sliding fit for the keys, so the cutter should be about 0.001 in. oversize. The vertical-slide is mounted and set at right-angles to the lathe axis and a machine vice attached to it and set so that the rod, when gripped, will lie truly horizontal.

A screw jack and steady will be required (see Fig. 3) and these are made from a piece of angle-iron clamped to the lathe bed, with a piece of steel, $\frac{1}{2}$ in. square will do, bolted to the vertical section. A screw and lock-nut provide height adjustment. The steady to prevent the rod wandering under tool pressure is made from a piece of mild-steel, with a $\frac{1}{4}$ in. reamed hole at one end, and a slotted hole at the other end, by which it is bolted to the side of the jack.

The limitation on the length of keyway which can be cut by this method is the distance from the lathe centre to the wall at the back of the lathe. The shaft is gripped in the machine vice with 21 in. extending across the lathe bed. The saddle is traversed up by the leadscrew handwheel until the cutter touches the side of the rod. The vertical slide is then lowered, and the saddle traversed a further distance, equal to half the shaft diameter plus half the width of the cutter, in this case 0.157 in. The saddle is locked in this position.

The lathe is started and the vertical-slide fed up until the cutter has cut to a depth of 0.050 in., after which, the lathe is stopped, and the jack and steady fixed in position. Cuting now proceeds until the cross-slide reaches the end of its travel. The lathe is again stopped, and the cutter and shaft firmly gripped by the fingers and thumb of the right hand whilst the machine vice is slackened and the cross-slide traversed in as far as possible. The vice is again tightened and cutting continued. This procedure is repeated until the end of the shaft is reached.

A hole is required at the rear of the saddle, to permit the cross-slide extension to pass through, and to drill this hole, a long drill is required. A piece of $\frac{1}{2}$ in. diameter steel 9 in. long is drilled at one end 7/32 in. diameter to a depth of about $\frac{1}{2}$ in. A $\frac{1}{4}$-in. drill is chucked and the shank turned to a drive fit in the 7/32-in. hole and driven in. Cross pinning will not be necessary if it is a good fit. The cross-slide and nut are removed and the drill passed through the hole in which the nut is located. The power used to drive the drill will depend on what is available. I used a carpenter's brace, and found



View showing operating lever and chain drive from leadscrew

this quite satisfactory. When the cross-slide is off, the screw can be removed for attention. Chuck it and drill the end 5/32 in. to a depth of $\frac{7}{16}$ in. Turn the end of the extension a tight fit for this hole, and cross pin with a piece of 16-gauge wire.

The remaining components require little comment. The sprockets 30 T. and 12 T. and chain 8 mm. were supplied by K. R. Whiston. The small sprocket requires a boss as shown. The swarf excluder is bent up from 20-gauge sheet steel or brass, and is attached to the end of the cross-slide by two 4-B.A. screws. This completely covers the mechanism at all positions of the cross-slide.

The main shaft is given end location by the sprocket boss at one end of the shaft bearing, and by a collar at the other end.

The large sprocket is attached to the inside of the leadscrew handwheel by bolts and spacing washers. The handwheel on my lathe is home-made, and fitting the sprocket presented no difficulty, but I cannot say what the position would be in the case of the standard Myford handwheel.

When all components have been made, the mechanism can be erected. With the cross-slide in position, and the extension projecting at the back of the lathe, hang the mounting plate on the extension and pass the mainshaft through the two lower bearings. Clamp the mainshaft bearing bracket to the lathe bed, about $\frac{1}{4}$ in. from the tailstock end, slip the mainshaft bearing on to the shaft, and clamp it to the top surface of the bracket, in such a position that the small sprocket, when placed on the shaft, will line up with the large sprocket on the handwheel.

With the mounting plate pressed closely against the back of the saddle, measure the distance from the rear edge of the shear to the centre of the mainshaft, and adjust the bearing on its bracket until this distance is equal at all points, along the length of the shaft. Measure the distance from the surface of the shear to the shaft, and adjust the position of the bracket on the lathe bed, up or down, until this distance is equal along the length of the shaft. Traverse the saddle the full length of the bed, and check for any tightness. If correct, the two holes may be spotted through the mounting plate, and drilled and tapped 2-B.A. Likewise, spot through the bearing bracket to the lathe bed and drill and tap 2 B.A.

The bearing bracket should be removed carefully without disturbing the bearing position, and two holes drilled and tapped 4 B.A. into the bearing. The thrust plate is attached to the ends of two bearing blocks on the mounting plate by two 4-B.A. screws, the position being located by a piece of rod through the bronze bushes on both plates.

Before screwing the mounting plate to the saddle, the ball and spring must be entered into the hole in the end bearing block. The intermediate shaft must be entered to prevent the ball coming through the hole in the bronze bush, but not pushed right through, as it would obscure one of the screw holes. With this screw fitted, the engagement sleeve and the relevant skew gear can be held in position whilst the intermediate shaft is pushed through.

With the engagement lever and operating lever in position, the remaining gears in their respective positions, and the sprockets and chain fitted, the mechanism is ready for use. It will be found that the cross-slide handle has a stiffer feel at first, as the skew gears are constantly in mesh, but this stiffness soon disappears as the gears and bearings get " run-in."

METHODS WITH MINIATURES

(*Continued from page* 425)

use a hand-tool for finishing and producing a true and unbroken curve. I know many people who have a genuine regard for hand-turned work, and cherish a desire to " have a go," but in the main, I don't think many people have tried it, due perhaps to several reasons—lack of tools, or material, or opportunity.

There is nothing to lose in attempting something along the lines described in this article, and it is more than possible that during the course of trying it out, a definite leaning for this kind of thing will become apparent, and the worker may well surprise himself with a natural skill he was unaware he possessed.

The last little " method " I wish to refer to concerns the single-wheel knurling tool. The orthodox manner of applying the knurling tool is on the diameter of the work, as is well known. However, a most decorative effect can be gained by clamping the knurling tool in the saddle, parallel to diameter, and applying to the face of the work.

It is necessary to have a small rounded bead just proud of the face contour, to accommodate the knurling tool wheel, and in order that the work may be done cleanly and without fear of fouling. The wheel used is of the curved type, and the markings reproduced are not unlike those of a circular rope effect, and are very striking. The work should be highly finished prior to knurling, as the latter operation is always done last.

In conclusion, may I say that should the worker try anything along the lines suggested here, it is most unlikely that he will complete his task without imbibing some knowledge, some little trick, which perhaps he alone will be able to employ in future work, and which he will never forget.

It is only by such experiences that skill is nourished and kept alive, and it is refreshing, to say the least of it, that one can still see some traditional examples of good individual workmanship. Those who have the opportunity of attempting something of this kind can escape, for a little while, at least, from this work-a-day world, which is ever more becoming repetitionary-mechanised.

The photographs illustrating this article were taken by William Bell.

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

SIX OR TEN WHEELER SENTINEL

DEAR SIR,—In your issue of February 17th, your correspondent asks for particulars of the "Sentinel" tar sprayer.

I saw and examined this engine 8 or 9 months ago and can assure anyone interested that she is a "Sentinel" D.C.6, which means she is a double-geared, rigid 6-wheeler.

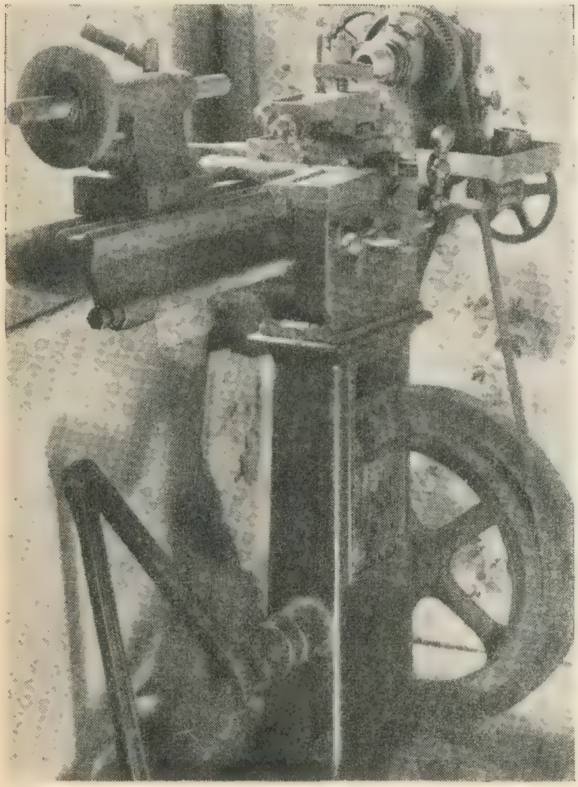
Sentinels did make a few of this type with only the two front wheels of the near bogie driving, but many drivers took off the driving chains connecting front and rear wheels of the bogie and thus converting it into a single-axle drive. The reason for this being that the vehicle ran faster and smoother than when all wheels were coupled.

Yours faithfully,
London, N.W. E. W. SHONE.

LEFT-HANDED LATHES

DEAR SIR,—With further reference to my letter in your issue of March 10th, only today I came across the enclosed old print of a "left-hand lathe" which came about, just as I described, by the insertion of a plate in its dark-slide, with the sensitised side to the back instead of to the front. As you will see there is nothing whatever that would indicate that this lathe was not really "left-handed," but if the screwcutting changewheel table could be read it would be seen mirror-fashion.

Yours faithfully,
Rustington. K. N. HARRIS.



THE WILLANS ENGINE

DEAR SIR,—In your issue of February 10th last, page 171, under "Information Wanted," regarding a Willans & Robinson engine, I am pleased to supply the following particulars.

Engine No. 3100 was delivered to customers in Rochdale on November 1st, 1900, being of 55 b.h.p. at 450 r.p.m., with 120 lb. p.s.i. at stop valve. Diameter of l.p. cylinders 12 in., effective area above piston 103.476 sq. in., diameter of h.p. cylinders 8½ in., effective area above piston 51.334 sq. in., stroke 6.1900 in.

Yours faithfully,
Rugby. E. M. ELBORNE.

CROSSHEAD FIXING

DEAR SIR,—Mr. Harris's assertion that a locomotive working on an up-and-down track needs less effort than one running on a continuous track, is most certainly *not* based on experience, as the very opposite is the case. Any driver would tell him that a locomotive on heavy shunting duties has far more stress imposed on its mechanism, than one making a long non-stop run.

Mr. Austen-Walton completely failed to understand the paragraph in my last letter, relating to the strength of the piston-rod at the point where it is drilled for a pin. I said that the area of the rod at that point is adequate, being greater than the pin, which is actual fact. If greater area is needed, one only has to adopt another method which "L.B.S.C." has described; that is, to fit two smaller pins, side by side, which is equivalent to a flat cotter, and easier than fitting one.

As Mr. Harris is partial to figures, here are a few that will prove that "L.B.S.C.'s" method of crosshead fixing not only stands up to the job, but to accurate figures as well. To consider the conditions mentioned in my last letter, we have cylinders 1⅜ in. diameter, bore, 3/32 in. diameter crosshead pin, and steam pressure of 80 lb. per sq. in.

Area of 3/32 in. pin = 0.0069 sq. in.
Area in shear = $2 \times 0.0069 = 0.0138$ sq. in.
Area of piston = 1.4849 sq. in.
Force on piston = $80 \times 1.4849 =$ 118.8 lb.

Shear stress in crosshead pin $= \frac{Load}{Area} = \frac{118.8}{0.0138} = 8{,}600$ lb. per sq. in

Shear stress $= \frac{8600}{2240} = 3.84$ tons per sq. in.

If silver-steel is used for the pins in its drawn and ground condition, the ultimate shear stress of this material can be reckoned as 56 tons per sq. in. Therefore, the safety factor $= \frac{56}{3.84} =$ 14 to 1. If, however, a mild-steel taper pin is used to B.S.S. 46, part 3, class A, and E.N. 1A steel of 28 tons per sq. in. in shear, the safety factor $= \frac{28}{3.84} =$ 7.33 to 1.

Other materials can, of course, be used, but a fairly good quality mild-steel gives the lower safety factor quoted. Loss of strength due to the reversing load does undoubtedly occur, but since the safety factor is fairly high, the loss of strength can be considered adequately provided for. Anyway, in a well-built "L.B.S.C."-designed locomotive, most of the running is with a steam-chest pressure well below boiler pressure. since these engines are well known to be particularly lively.

As a point of interest to readers, I will give the stresses existing in the cotters of various full-size locomotives. Note that, in all cases, these are rather greater than those which exist in our smaller locomotives. They are taken from the Locomotive Engineers' Pocket Book, and the stresses are as follows 4.38, 6, 5.65, 12.00, 5, 5.2, 8.3, 10.3, and 7.5 tons per sq. in.

Yours faithfully,
Ashford, Kent. A. R. DONALDSON.

HOT AIR ENGINES

DEAR SIR,—I have just obtained a copy of *The Steam Engine* by T. M. Goodeve, M.A., Barrister-at-Law, London (Crosby Lockwood, 1889).

At page 97 in this book, paragraph 65 states: "Stirling's engine is supplied with compressed air; that is an essential condition, for otherwise the power developed would be insufficient to move the working parts. In one example, the pressure of the air varied from 160 to 240 lb. per sq. in. . . ."

The engine failed, at the time, because the materials and lubrication available in the last century could not stand the pace.

But we have today, far better materials and lubrication of enormously improved availability. If we can lubricate the diesel cylinder, we ought to be able to cope with the high temperatures of a hot-air motor.

None of the miniature hot-air engines shown in THE MODEL ENGINEER has had this high compression, and it would be worth while to investigate whether a good hot-air engine could be made, for these reasons :—

(*a*) There is a vast mass of waste and refuse which has to be burnt, so we ought to get energy from its heat.

(*b*) The cost of high-quality fuels increases continually.

(*c*) Governments tax petroleum products to fantastic figures, as in the United Kingdom.

(*d*) The diesel engine is expensive, causes noise and vibration, and requires a delicate fuel pump.

(*e*) If a power unit needing only fire and lubrication could be had, at a reasonable price, its practical field of application might be immense, and the manufacture of it could become an industry on the large scale.

(*f*) An engine of from 4 to 50 h.p. would be a suitable size for performing tasks now done by steam, oil, or the wind, on farms, etc.

Yours faithfully,
London, N.W. H. H. NICHOLLS.

FACTS AND FIGURES

DEAR SIR,—Mr. John G. Steel, in the March 31st issue, uses the term "mathematics" in its widest possible sense, but in any case I would assure him that I have a keen appreciation of the value of mathematics in engineering science, though I also contend that like every other process, tool or appliance, it has its limitations as well. My main objection is to the attempt to use mathematics without adequate basic data, which despite Mr. Steel's comments on the function of research establishments, is still, I contend, obtained experimentally. If he can demonstrate that I am wrong, by designing engines on the basis of figures and formulas derived in any other way, I am sure thousands of model engineers will hail him as a benefactor.

Geometry, of course, is an essential part of engineering *practice*, as it governs all methods of metal working and machine tools used in engineering, and its application to the design of valve gears, etc., is not "mathematical calculation" in the sense I had in mind. The field of astro-physics is, of course, a happy hunting ground of the mathematician, but although the astronomer cannot bring a star into his laboratory, it is subjected to experimental research by the use of the spectroscope, the thermopile and the transit telescope. I am aware of the work of Clerk Maxwell and also Oliver Heaviside, which I agree has been of inestimable value in their respective spheres; but with regard to the comments of the latter on the subject of mathematics, this could be boiled down to two words—"Sour Grapes!"—which is certainly not the attitude of the earnest seeker after truth, who is only too willing and ready to use every means to this end which may be available. As a contrast, however, Michael Faraday, whose claim to greatness is certainly no less firmly established, was never convinced by any theory or formula unless it could be demonstrated experimentally; and the practical results he obtained often refuted the findings, previously accepted without question, of the "academic" school of scientists. In a letter to Clerk Maxwell in 1857, he said: "When a mathematician engaged in investigating physical actions and results has arrived at his own conclusions, may they not be expressed in common language as fully clearly and definitely as in mathematical formulae? If so, would it not be a great boon to such as we to express them so—translating them out of their hieroglyphics that we also might work on them by experiment?"

I will frankly admit that I am not an expert mathematician, but I have never failed to take advantage of the assistance that others, better educated than myself in this respect, could give in elucidating engineering problems. Despite my limitations, I have designed and produced many engines which, strangely enough, worked!—perhaps they might have worked better if I had known more about the "pie-over-steak-and-onions" side of the job. However, the moral is plain—co-operation between the horny-handed "tons of soil" and the "No. 8 Hats" is the only sure road to progress.

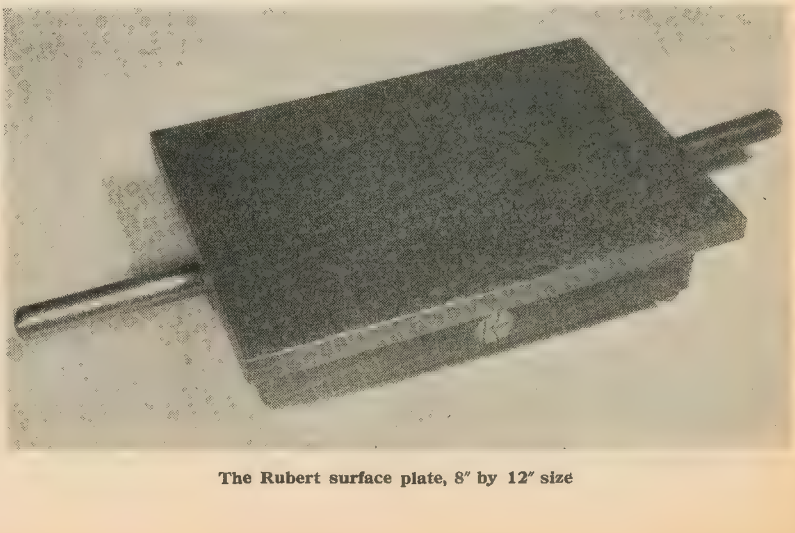
Yours faithfully,
EDGAR T. WESTBURY.

Surface Plates

A NEW type of surface plate by Messrs. Rubert & Co. Ltd., Chapel Street, Stockport Road, Levenshulme, Manchester, for which patents have been applied, incorporates a special form of ribbing on the underside, which relieves stresses in the centre, thereby giving greater stability and retention of accuracy. By coring out a slot in the centre rib, a means of manipulating the plate with one hand is obtained, and this facilitates the task of applying it to fixed surfaces, and relieves fatigue, as the central handle keeps it in balance. When resting on the bench, it is supported at three points, consisting of adjustable screw feet by which it can readily be levelled.

The plates are made in a range of eight sizes, up to 18 in. by 18 in., and can also be supplied with cross-grooving for precision lapping. They are made in close-grained cast-iron, and conform to British Standard limits of accuracy (B.S. 817), with a surface-finish within a limit of 8 micro-inches. All plates are supplied with two steel carrying handles in addition to the centre handle.

A sample plate has been submitted for our inspection, and, although we are not equipped to carry out precision tests on it, the general quality conforms in every way to the maker's claims so far as can be ascertained.



The Rubert surface plate, 8" by 12" size

WITH THE CLUBS

Romford Model Engineering Club

The 21st anniversary of the Romford Club is this year. To mark the occasion, a very ambitious programme has been prepared by the Club's energetic committee.

On Thursday, March 17th, 1955, a most excellent and informative talk was given by Mr. Chaddock, who is well-known to "M.E." readers for his experiments with steam turbines. Mr. Chaddock's talk was devoted to his new gas turbine—an intricate and beautifully made piece of apparatus. Although a demonstration was not yet possible, we hope to hear of successful trials in the near future.

Coming events include:—

April 21st.—Mr. Carr will be testing members' injectors, and there will be a demonstration of a Stroboflash—an electronic device for "stopping" movement for observation of fast running apparatus.

May 7th.—An exhibition of members' work.

May 15th.—A visit to the Watford track.

May 30th.—Romford will be entertaining members of the Birmingham Society.

Meetings are held on the 1st and 3rd Thursdays of each month with track running on Saturdays at the Lambourne Hall (Red Triangle Club), Western Road, Romford, Essex. Visitors and new members are always welcome.

Hon. Secretary: W. S. Rutter, 154, Glenwood Gardens, Ilford, Essex.

The Rochdale S.M.E.

At a recent meeting Mr. R. Gardiner spoke on "Fibre Glass Experiences." This new medium, fibre glass cloth, and synthetic resins, opens up new methods of complicated shape fabrications, and the speaker exhibited to the members a drilling machine belt guard made by these methods. This is now fitted to the bench drill designed and made by Mr. Gardiner, which won the Harper Trophy at the 1954 Northern Models Exhibition and the guard being described adds finish to an excellent machine tool. Describing his experiments from design, templates and mould making, to the completion of finished component, he was able to arouse great interest in this method of production. Much discussion followed this interesting talk by our member, and the members unanimously agreed that here was the best material obtainable to make model boat hulls. Maybe, this will be the inspiration resulting in the launching of more model craft in the future.

The speaker at the April 15th meeting will be Mr. L. Barlow, the subject being "Building a Workshop." All local readers are welcome to attend.

Mr. W. F. Jackson was awarded the Harper Trophy at the recent Northern Models Exhibition, for his engraving machine, and we are therefore retaining this trophy in Rochdale for the next twelve months.

Hon. Secretary: Mr. E. Hincliffe, 18, Verdun Crescent, Rochdale.

Croydon S.M.E.

The society will be staging an exhibition of models on Saturday, April 30th, at the showrooms of Alban Crofts, Coachbuilders, Brighton Road, South Croydon, by kind permission of the proprietors. Opening at 2 p.m., admission is free, and all interested are welcome. All main road London and country buses pass the door and stop at the "Red Deer," less than one minute's walk down the road.

The Croydon Society portable multi-gauge track will be in use and several locomotives will be "in steam" ready for passenger hauling. Stationary models will be working by compressed air and there will be a "OO" gauge section, boat section and items of general model engineering interest. The Croydon Cine Club is also participating, and will be showing sound films and exhibits of their handiwork.

Hon. Secretary: E. R. van Cooten, 29, Kingsdown Avenue, South Croydon, Surrey.

The Tyneside S.M.E.E.

The next meeting of the society will be on Saturday, April 16th, at 2.45 p.m. in the rooms of the Newcastle Photographic Society, 6, Rutherford Street, Newcastle upon Tyne. By the courtesy of the Vacuum Oil Co. Ltd., there will be a film on "Lubrication"—a subject of direct interest to *every* member.

Apropos those members who (possibly because they had no direct interest in racing cars) were absent from the "Maskelyne" lecture, missed one of the most entertaining afternoons we have ever had. There was a disappointingly poor attendance.

The new treasurer is Mr. L. H. Weedon, 10, The Drive, Longbenton, Newcastle, 7.

Members and friends of the society will learn with regret of the death on March 25th, of Mr. W. Thompson, treasurer of the society since its formation. He will be sadly missed.

Hon. Secretary: L. Jamieson, 7, McEwan Gardens, Newcastle upon Tyne, 4.

Evershed's S.A.A. (Model Car Section)

An open meeting will be held, in conjunction with the Miniature Motor Sport Club, at the Sports Ground, Westlea Road, Boston Manor, West London, on Sunday, May 1st. The circuit will be open from 10.30 a.m. Entry forms, which should be completed and returned before Monday, April 18th, are available from the Hon. Secretary, E.S.A.A. (Model Car Section), c/o Evershed & Vignoles Ltd., Acton Lane Works, Chiswick, London, W.4.

Tees-side S.M.E.E.

At a meeting held in Middlesbrough recently, a talk illustrated by lantern slides was given by Mr. A. V. Buttress, River Superintendent to the Tees Conservancy Commission. The speaker dealt with the many problems arising from the use and control of the traffic on the river, including the lightships and buoys, soundings and dredging, the recovery of wrecks and many others. The talk was greatly appreciated by members.

Hon. Secretary: J. W. Carter, 28, East Avenue, Billingham, Co. Durham.

The Tonbridge and District Model Railway Club

The club's new "OO" 16.5 mm. layout is beginning to take shape, tracklaying has been started on the end and centre sections.

A Junior Section has been started to cater for enthusiasts from 14 to 18 years, and intermediates from 18 to 21 years. Junior members will only be admitted at the committee's discretion.

Applications and particulars of forthcoming meetings can be obtained from the Hon. Secretary, B. J. Hoath, 14 Oakmead, Tonbridge.

Birmingham S.M.E.

At the A.G.M. of the above society held recently, it was reported that the society is still in a very healthy and flourishing condition. In spite of the bad weather of 1954, we completed what was a very full and successful programme of outdoor events, including the most successful National Rally to date.

Several projects for further developments at the track are still in mind, and any help there would be greatly appreciated.

It is hoped to hold an exhibition in 1956 on similar lines to the one held in 1953, which was so successful.

Prospective members are requested to apply for further details of the society to the Hon. Secretary: Mr. J. E. Guy, 21, Kenwood Road, Bordesley Green East, Birmingham, 9.

The Junior Institution of Engineers

Friday, April 15th, at 7.0 p.m.—Pepys House, 14, Rochester Row, S.W.1. Ordinary meeting—Paper: "The Design of, Materials Used In, and The Manufacture of Pick Steels for Pneumatic Picks," by C. Hutchinson.

Sheffield and District Section. Monday, April 18th, at 7.30 p.m., at Livesey Clegg House (opposite Union Street Cinema), Sheffield. Ordinary meeting: Paper—"The Organisation of an Engineering Company," by F. Sargeant, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E. (Senior Partner: Urwick, Orr & Partners Ltd.).

Friday, April 22nd, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Informal meeting—Paper—"Some Preliminary Notes on the 'Electronic Brain' in the Automatic Factory," by W. J. Kease (Member and Durham Bursar).

THE MODEL ENGINEER DIARY

April 14th, 15th and 16th.—The Model Railway Club Exhibition, at the Central Hall, Westminster, London, S.W.1. Open from 10.30 a.m. to 9.0 p.m.

April 16th, 18th, 19th, 20th, 21st, 22nd and 23rd.—Stockport and District Society of Model Engineers.—Exhibition of models at the Lads' Club, Wellington Street, Stockport. Open on Saturdays 10.0 a.m. to 9.0 p.m. Monday to Friday 6.0 p.m. to 9.0 p.m.

April 30th.—Croydon Society of Model Engineers.—Exhibition of models at the showrooms of Alban Crofts, Coachbuilders, Brighton Road, South Croydon, Surrey. Opening time—2 p.m.

May 6th and 7th.—Crewe Model Engineering Society.—Exhibition of models in The Corn Exchange, Crewe.

May 22nd.—Forest Gate Model Power Boat and Engineering Society Regatta at Victoria Park, Hackney, London, E.9. Starting at 11.0 a.m.

May 28th.—Welling & District Model Engineering Society Regatta at the Belvedere Recreation Ground. Starting at 2.30 p.m.

May 30th.—Bournville M.Y. & P.B.C.—Regatta at the Valley Pool, Bournville Lane, Birmingham. Starting at 11.30 a.m.

June 11th and 12th. — Birmingham Society of Model Engineers.—Annual National Rally of Steam Locomotives at the track at Campbell Green, 87, Horse Shoes Lane, Sheldon, Birmingham.

June 25th and 26th.—The West Riding Small Locomotive Society.—Rally of Model Locomotives, Gauges $2\frac{1}{2}$ in. to $7\frac{1}{4}$ in., at Blackgates House, Bradford House, Tingley, Wakefield. Open from 10 a.m. to 10 p.m., both days.

August 17th, 18th, 19th, 20th, 22nd, 24th, 25th, 26th and 27th.—The Model Engineer Exhibition, in the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9.0 p.m.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, The Model Engineer, 19-20, Noel Street, London, W.1.

Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

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Immediate Delivery from Stock. Myford "M.L.7" and "Super 7" lathes, Grayson, Super Adept lathes, bench planer, shapers, electric motors, small tools.—F. W. Kubach, 12, Sylvan Road, London, S.E.19. LIV. 3311/12.

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Government Surplus. Wimet tipped lathe tools, $\frac{1}{4}$", $\frac{5}{16}$", $\frac{3}{8}$" square, sets 12 tools, price £2 10s. Cash, or £1 deposit and seven payments of 5s. New M.L.7, Little John, Boxford, and Malcor lathes. Part exchanges, used lathe list 1s. Hire purchase. Send your order to Corbett's (Lathes), Stanton Hill, Sutton-in-Ashfield.

Unrivalled in its Class. The E.W. $2\frac{1}{2}$" × 10" lathe. Model "A" plain lathe £13 4s. 0d. Fully convertible to back gear and screwcutting. Can be obtained from 5s. weekly. No interest no fuss credit terms. Details s.a.e.—Wanstead Supply Co., 48, High Street, London, E.11.

Take a Tip! It may be "Wimet." Grind with "Diadisc" from Millett! $1\frac{1}{2}$" diamond lap, $\frac{1}{2}$" taper bore, 25s. 9d.—W. J. Millett, C.M.B.H.I., St. Ives, Huntingdon.

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Shaper Pedestal type 6" bellow make, £35.—46, Mashiters Walk, Romford, Essex. Romford 9624.

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High Speed Sensitive Power Bench Drilling Machine. Chuck capacity $\frac{3}{8}$", £6 10s. or credit terms 2s. 6d. weekly. Send s.a.e. for descriptive pamphlet.—Wanstead Supply Co., 48, High Street, London, E.11.

Half H.P. Electric Motors. 230 volt, single-phase, ball-bearing induction motor, 2,800 revs. by English Electric 60 only, £5 each plus 10s. carriage and packing, worth, £11.—Mibro Equipments Ltd., 81, Derby Road, Nottingham.

Wanted. Atlas, Halifax, Sphere or similar lathes. Please state condition and list equipment.—Box No. 7666, Model Engineer Offices.

For Sale Drummond $3\frac{1}{2}$" M-type lathe, drilling machine, grinder, 1/3 h.p. motor, chucks, vertical-slide, micrometer, surface plate, surface gauge, brazing lamp. Partly completed "Maisie." Oxford area, view.—Burden, 9, Distons Lane, Chipping Norton.

Flexispeed $1\frac{7}{8}$" backgeared lathe, countershaft, etc., £6. $2\frac{3}{8}$" by 7" geared bench lathe compound slide-rest, auto-feed, s.c. chuck, £8. Addressed envelope full particulars.—Box No. 7675, Model Engineer Offices.

Atlas Screwcutting lathe, 6 in. faceplate, 30-in. bed. Complete on bench with $\frac{1}{4}$-h.p. a.c. motor, all accessories. Excellent condition, £30.—Biddle, 4, Sunnymead Road, London, N.W.9.

Wanted Lathe and other engineering equipment.—McGaughney, 51, Mullway, Letchworth, Herts.

Wanted. Super Adept lathe with accessories.—Box No. 7696, Model Engineer Offices.

Drummond Lathe, very good condition, £27 or near offer.—Upminster 4451.

The Remarkable "Handiheat" brazing and soldering kit, includes gun, all materials, instruction booklet, etc. This is professional equipment for the home workshop, 9s. 6d. including carriage, or s.a.e. for details.—Paisley Products, 3, Greenhill Avenue, Caterham, Surrey.

4" Planer, $\frac{1}{4}$ h.p. motor, multi purpose spindle, 6" circular saw, practically new, £13.—Eastwood, 73, Cheriton Road, Folkestone, Kent.

Wanted. Myford M.L.7, Super 7, Boxford, or Littlejohn lathe. Cash. Can collect London area.—Advertiser, 2, Isabella Road, Homerton, London, E.9.

For Sale. Motorised $3\frac{1}{2}$" Centre Grayson lathe and accessories and 4" chuck, £30 or near offer.—Box No. 7691, Model Engineer Offices.

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A.C. Motors, Delco Capacitor, start induction, 200/250 V, 50 cycles, 1 phase, 1,425 r.p.m., ¼ h.p., £3 12s. 6d.; 1/3 h.p. £4 17s. 6d., ½ h.p., £6 10s. 0d. Perfect and guaranteed. Passenger carriage, 5s.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/3.

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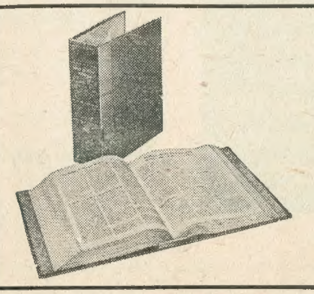

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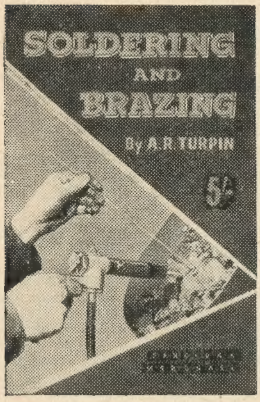

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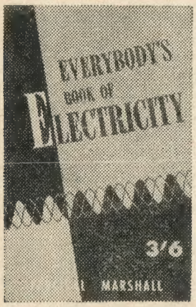

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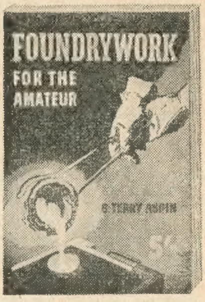

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